

# CA | Energy Efficiency Strategic Plan

## **Lighting** Action Plan: Best Practices 2010-2012

Developed by Lighting Stakeholders

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## OVERVIEW

This Lighting Action Plan is designed to help achieve the goals described in the California Long Term Energy Efficiency Strategic Plan (the “Strategic Plan” or the “Plan”) published in 2008 and updated in 2010.<sup>1</sup>

## BACKGROUND

The first iteration of the Strategic Plan included energy efficient lighting as a small component of both the residential and commercial chapters. However, with lighting accounting for approximately 24 percent of the state’s electricity consumption and over 50 percent of investor-owned utility (IOU) program savings in California, the need to develop a vision for a transformed lighting market was widely recognized.<sup>2</sup> With evidence of significant market transformation primarily in compact fluorescent lamps (CFLs) and high-bay fluorescent lighting<sup>3</sup>—as well as recent lighting studies suggesting substantially lower savings from these measures than anticipated<sup>4</sup>—the state urgently needed to expand the role of lighting in its strategic planning efforts. The workshops leading to the development of the lighting chapter of the Strategic Plan also included working with volunteers to design and implement this action plan. Many of these volunteers are poised to implement the action plan as champions of specific milestones.

Following are details on the individual public workshops including purpose and outcomes.<sup>5</sup>

1. **December 16, 2008—California Lighting Technology Center (CLTC) in Davis.** This meeting identified technologies and design practices for market transformation to be prioritized for incorporation into IOU<sup>6</sup> programs.
2. **April 6, 2009—California Public Utilities Commission (CPUC) in San Francisco.** This workshop reviewed initial vision, goals and strategies for the lighting chapter.
3. **October 8, 2009—CLTC in Davis.** This workshop focused on developing a bold vision and goals for the lighting chapter.
4. **November 5, 2009—Finelite Lighting in Union City.** This workshop focused on developing draft strategies and near-, mid- and long-term milestones.
5. **December 10, 2009—Southern California Edison’s (SCE) Customer Technology Application Center in Irwindale.** This workshop focused on refining milestones and identifying measurable results for goals and strategies.

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<sup>1</sup> CPUC, 2010. The California Efficiency Strategic Plan. Last modified October, 2010, accessed January 17, 2011, <http://www.californiaenergyefficiency.com/docs/EEStrategicPlan.pdf>.

<sup>2</sup> California Energy Commission, 2003. California Energy Demand Forecast 2003-2013: Staff Report. Prepared in Support of the Electricity and Natural Gas Report under the Integrated Energy Policy Report Proceeding (02-IEP-01). August 2003.

<sup>3</sup> KEMA, Inc. and Itron, Inc., 2010. High Bay Lighting Market Effects Study—draft document. Prepared for the CPUC Energy Division. May 3, 2010.

<sup>4</sup> KEMA, Inc., 2010. Final Evaluation Report: Upstream Lighting Program, Volume 1. Prepared for the CPUC Energy Division by KEMA, Inc. with support from The Cadmus Group. February 8, 2010.

<sup>5</sup> “Workshops & Public Events,” last modified December 3, 2010, accessed January 13, 2011, <http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/EE+Workshops>.

<sup>6</sup> California’s investor-owned electric utilities include Pacific Gas & Electric (PG&E), San Diego Gas & Electric (SDG&E), and Southern California Edison (SCE).

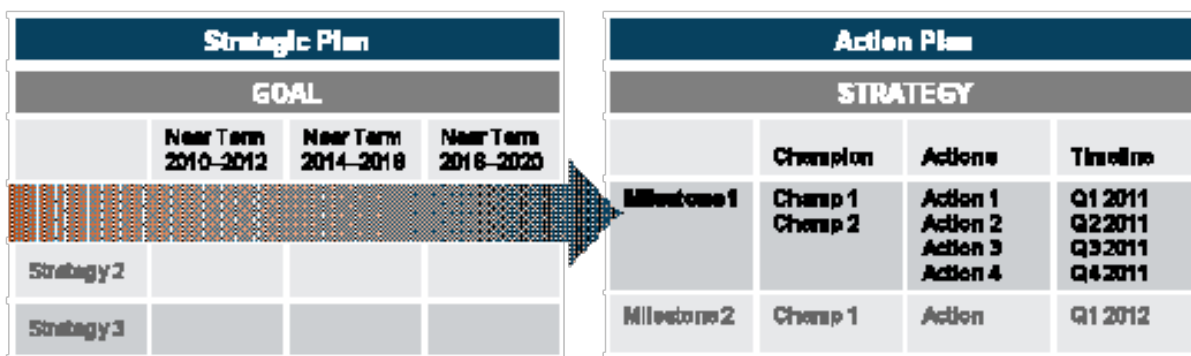
6. **April 5, 2010–Sacramento Municipal Utility District (SMUD) in Sacramento.** This workshop focused on initial efforts to launch the Lighting Action Plan, including suggestions on champions and specific actions to reach milestones.

## THE STRATEGIC PLAN

Published in 2008, the Strategic Plan outlines goals and strategies for key market sectors (commercial, residential, etc.) and crosscutting resources (e.g., HVAC).<sup>7</sup> In order to reduce barriers to the adoption of efficiency measures (to the point where publicly funded intervention is no longer appropriate or necessary) the Plan embraces four specific programmatic goals, known as the Big Bold Energy Efficiency Strategies or “BBEES” set forth in CPUC Decision 07-10-032.<sup>8</sup> This focus on market transformation and recognition that deep energy savings can only be achieved through a common vision and coordinated efforts of both utility and non-utility entities is the fundamental point of departure for the Strategic Plan. Unlike traditional regulatory approaches, the Plan identifies near-term, mid-term and long-term milestones to move the state towards these BBEES. The Big Bold Energy Efficiency Strategies are:

- All new residential construction in California will be zero net energy by 2020.
- All new commercial construction in California will be zero net energy by 2030.
- Heating, Ventilation, and Air Conditioning (HVAC) will be transformed to ensure that its energy performance is optimal for California’s climate.
- All eligible low-income customers will be given the opportunity to participate in the low-income energy efficiency program by 2020.

As part of the Plan’s efforts to achieve maximum energy savings via the BBEES, innovations in a range of technologies, services and even philosophies in program design are required. Stretching beyond the scope and participation of the existing ratepayer-supported utility programs, achieving the goals in the Strategic Plan requires involvement of stakeholders outside of IOUs. While the Strategic Plan is a policy-oriented document that sets forth leadership and vision, the Lighting Action Plan is a way to operationalize the lighting goals of the Strategic Plan. Not only does this document help the broader California community proceed step-by-step toward achieving the Strategic Plan’s lighting vision, but it also provides meaningful engagement for stakeholders. The action plan focuses on the Strategic Plan’s four goals for the lighting sector: policy for market transformation (Goal 1), best practices (Goal 2), end user demand (Goal 3) and research, development and demonstration (or RD&D, Goal 4).



<sup>7</sup> CPUC (Sep 2008), Table of Contents.

<sup>8</sup> Ibid, p. 4.

## THE ACTION PLANS

Engaging industry leaders and influencers—as well as relevant agencies, utilities, and other stakeholders—is critical for successful implementation of the Strategic Plan. To make stakeholder participation in strategic planning activities meaningful and focused on achieving milestones, the Lighting Action Plan is designed to identify the key actions required to achieve milestones, secure leaders for the steps to achieve these actions, and track and report on progress against the Strategic Plan. To facilitate comprehension and action by the broadest cross section of stakeholders as possible, this roadmap relies more heavily on graphics and summation than the Strategic Plan. The Lighting Action Plan is based on a literature review, a series of public workshops (related to both new construction and existing buildings), ongoing outreach to key stakeholders and participation in both state and national efforts (see Appendix C).

**Prioritized Strategies.** The Lighting Action Plan is designed to achieve milestones identified in the Strategic Plan. However, with more than 60 milestones in the sector recommended for implementation in 2010–2012 alone, actions must be prioritized. Moreover, given both the dynamic nature of the energy efficiency marketplace and concurrent efforts in other sectors, the Lighting Action Plan does not seek to launch all milestones identified in the Plan by 2011, nor does it provide a highly detailed plan for the entire near-term (2010–2012) implementation. It does not catalog every lighting-related activity currently underway in California; that is not its purpose. The Lighting Action Plan does, however, include information on a number of activities already underway in support of the priority activities.

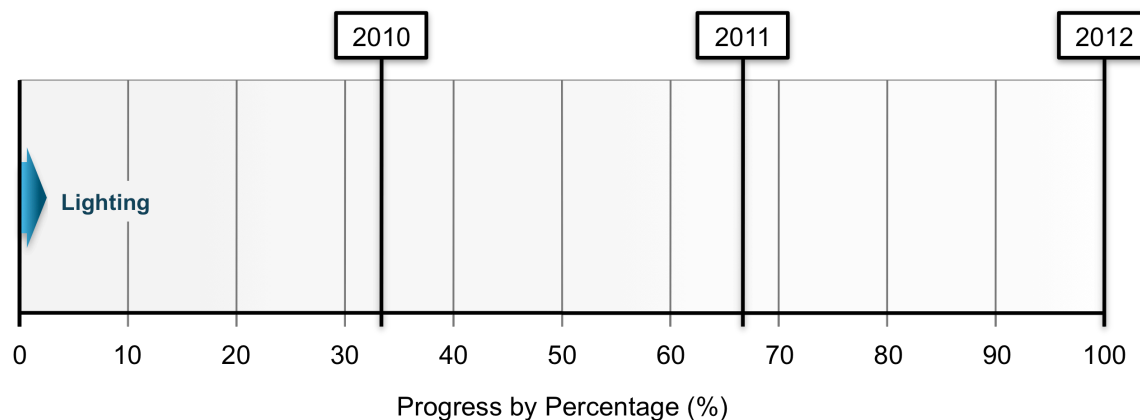
**Champions Network.** A core focus of this action plan is continued work with the broader stakeholder community, including manufacturers, contractors, local governments and others. It is essential to track progress, foster accountability and acknowledge success, as well as generally provide high-level coordination to accelerate progress. Industry leaders are being continuously identified—and stepping forward—to take on responsibility for the achievement of specific milestones in the Strategic Plan. These champions include people from relevant state agencies, buildings industry, utilities and a range of trade groups and nonprofit organizations. Many of the champions who have volunteered are already working on some aspect of the action plan in their professional work. In the near-term, the CPUC will serve as a central organizational point for Plan champions, providing both online ([www.Enage360.com](http://www.Enage360.com)) and offline facilitation of the champions' network, as well as tracking progress towards milestones. Additional champions from the broader marketplace will be essential to truly institutionalize the Plan in the fabric of the state.

**Action Detail.** With more than 100 pages and even more strategies across 12 sectors, the Plan must be segmented into a series of discreet achievable tasks that together result in achievement of milestones. Essentially, the action plan is project management applied to a policy document. Tasks aligned with a milestone (displayed as “key actions” in the ensuing pages) are developed in coordination with stakeholders and industry experts. Tasks are ordered in a step-wise approach to achieve milestones, and are the heart of the action plan. Additionally, project management tools are employed to (a) identify groups already working on key issues related to the Lighting Action Plan, (b) identify champions who can take responsibility for specific milestones, (c) estimate time to complete a specific action and (d) record progress to date.

**Progress Indicators.** Action plans, by providing the ability to track progress, vastly improve California's chances of achieving the goals of the Strategic Plan. Progress indicators, based on a simple calculation, enable a “bird's eye view” of areas of significant achievement, as well as areas where additional resources or support are needed to stay “on track” to achieve the Plan's goals. For each milestone, there are an established number of actions. Progress is measured as “percentage complete” by dividing the number of actions completed by the total number of actions. While it may be ideal to develop a weighted approach (as achieving some milestones have a significant ripple effect) or to develop a formula that

equates a score with activities that are ahead of, behind, or on schedule, this simple method provides a general gauge for progress against the Plan. Processes that are considered “ongoing” (such as updating codes) will be listed as one-third (33 percent) complete as of January 2011, as the first of three years of the Plan’s near-term (2010–2012) implementation cycle. Non-priority strategies do not have these indicators.

**Overall Progress.** In addition to the progress tracking at the strategy level, the Lighting Action Plan provides a snapshot of progress against the Plan’s lighting goals in totality. To be considered “on track,” overall indicators reflect milestones for the 2010–2012 cycle that are generally one-third complete at the end of 2010, two-thirds complete at the end of 2011, and 100 percent complete at the end of 2012. Assuming steady progress in each year of the 3-year Strategic Plan cycle, near-term milestones (those included in this action plan), should be approximately 50 percent complete by mid-2011. To estimate overall progress toward action plan goals, the individual “percent complete” is aggregated across all milestones and divided by the total number of milestones for average (or overall) progress. Unfortunately, the Lighting Action Plan is not currently on track with only approximately 3 percent of progress achieved to date (as shown in the figure below). (Note: Given that lighting chapter of the Strategic Plan was just published at the end of 2010; it would be unrealistic to expect the same level of progress as other sectors.)



## THE STATE OF THE LIGHTING MARKET

Even with aggressive appliance and building code standards, lighting represents approximately one quarter of residential and commercial electricity use in California.<sup>9</sup> Already a fragmented industry, the energy efficient lighting marketplace has experienced an influx of competition and venture-backed start-ups due in part to increasing government incentives and low offshore manufacturing costs. Historically, the lighting industry has been dominated by the “Big Three” lamp and ballast manufacturers (Osram Sylvania, Philips, and General Electric) and the top fixture manufacturers (such as Acuity Brands, Cooper, Hubble and Philips). Today the lighting industry is in the process of fundamental changes with the introduction of solid state lighting (SSL) technologies including light emitting diodes (LEDs). These digitally based technologies — along with other advanced products, controls, systems and standards — have the potential to revolutionize the lighting industry in many ways including longer lifetimes, easier controls and digital systems that integrate with renewable and smart grid technologies. The number of smaller players seeking to compete for market share in the energy efficiency category is rapidly

<sup>9</sup> Lighting represents 22 percent of residential electricity use (CPUC, 2010) and 35 percent of commercial electricity use (Itron, 2006. California Commercial End-Use Survey. Prepared for the CEC. Publication # CEC-400-2006-005. March 2006.).

expanding, and delivering a wealth of emerging technologies to help achieve the 60–80 percent reductions in statewide lighting electrical energy use called for in the Strategic Plan.

While some of the technology is at hand to achieve the goals of the Plan, the economic recession that began in 2008 may challenge the broad adoption of best practices<sup>10</sup> as outlined in the Strategic Plan. Economic decisions in building lighting involve the selection of one technology or design approach over another based predominantly on a complex comparison of initial and operating costs.<sup>11</sup> While the Plan proposes twice the potential savings in comparison to standard practices, the best lighting technology may also involve significantly higher upfront cost and fall outside the traditional definitions of cost-effective use of energy efficiency dollars (typically a 2–4 year simple payback). Still, with nearly 7 billion square feet of floor space in California’s commercial sector alone—three percent of which is newly built or renovated annually—numerous opportunities will present themselves annually to “go deep” (e.g., retrofits resulting in 50 percent savings) with energy efficient, best practice lighting.<sup>12</sup>

With the advent of the Strategic Plan, utility programs (2010–2012) have new features that support achieving zero energy and encourage best practices, including the High Performance Office Lighting program, the Advanced Consumer Lighting program and the Lighting Market Transformation (LMT) program.<sup>13</sup> California’s state agencies are focused on substantial reduction of building energy use (leading to zero energy buildings) and private efforts (including from the architectural, engineering, and green building communities) are changing energy-use aspects of the built environment. As exemplified by the Zero Net Energy (ZNE) Commercial Action Plan, there is a sustained multi-party effort in the state that has put California on the path to transform how buildings are designed, constructed and operated—including lighting.

## CRITICAL SUCCESS FACTORS

- **Planning cycles.** The ability to achieve the goals in the Lighting Action Plan is affected by three unaligned planning cycles: the California Energy Commission or CEC (annual plans), CPUC/IOU incentives (3-year plans), and corporate and consumer payback tolerances (1–3 years). If California can identify ways to “true up” these cycles—while demonstrating ongoing commitment to energy savings—the state may be in a better position to support the next generation of buildings and systems envisioned by the Strategic Plan.
- **Market leadership.** The market includes a wide variety of players with divergent perspectives as well as thousands of manufacturers, services providers, and building occupants. Any effort to change the lighting landscape must leverage market leaders where change is most possible, while also changing market perceptions.

<sup>10</sup> Per the Strategic Plan’s lighting chapter, best practices are “Coordinated technologies, systems and design approaches, which (through research and experience) demonstrate the ability to consistently achieve above standard results while avoiding negative environmental impacts. Best Practices change over time as improved components, technologies, systems and design approaches become available.” (CPUC, 2010. Page 119.) Appendix A provides further details regarding best practice lighting technologies, systems, and approaches.

<sup>11</sup> Siminovitch, M. J., n.d. “LEDs: The Next Generation Light Source A review of the key technology and market drivers and the directions for high-efficiency lighting” (white paper). University of California, Davis. Page 36.

<sup>12</sup> “Untapped Potential of Commercial Buildings: Energy Use and Emissions; Capturing Wasted Energy: Efficiency, Retrofits, Barriers,” accessed January 21, 2010, [http://www.next10.org/next10/pdf/NXT10\\_BuildingEfficiencies\\_final.pdf](http://www.next10.org/next10/pdf/NXT10_BuildingEfficiencies_final.pdf).

<sup>13</sup> For more information regarding the investor-owned utilities’ 2010-2012 energy efficiency programs, see (for example) Pacific Gas & Electric Company’s “Energy Efficiency Program Descriptions” at <http://www.pge.com/about/rates/rebateprogrameval/programdescriptions/>.



- **Financial viability.** Financial mechanisms that reward, or at least support, deep energy savings need to be developed, including lighting best practices that enable achievement of ZNE. This may include addressing how the state rewards and evaluates energy savings, as well as creating unique financing sources.
- **Statewide coordination.** There is need for a broadly representative group, including a range of public and private sector volunteers, to help coordinate efforts to advance this action plan. Achieving a 60–80 percent reduction in lighting electrical energy use will require actions related to code development, design and financial mechanisms. California must facilitate long-term commitments to the Strategic Plan from both public and private institutions.
- **Track and report on progress.** In order to advance the Strategic Plan’s goals and strategies, the Lighting Action Plan must track and report on progress. Ongoing stakeholder engagement will benefit from visible demonstrations of success and how the strategies and milestones are working both independently and collectively to achieve Plan goals.

## THE 2010–2012 ACTION PLAN

The Lighting Action Plan includes:

- **Strategies.** An overview of the strategy and why it is important to focus on these activities now.
- **Progress to Date (2010–2012).** A graphical depiction of milestone progress, based on percent complete in the action plan. This section also includes an overall status summary, as well as examples of progress.
- **Action Plan (2010–2012).** Identifies the milestones to achieve the strategy and has specific activities, is time bound and is aligned with champions in the industry.

## GOAL 1: POLICY FOR MARKET TRANSFORMATION

The following five strategies are focused on Goal 1: “Develop and implement coordinated policies, procedures and other market interventions that eliminate barriers, accelerate lighting market transformation in California and provide incentives for best practice lighting technologies and systems.”

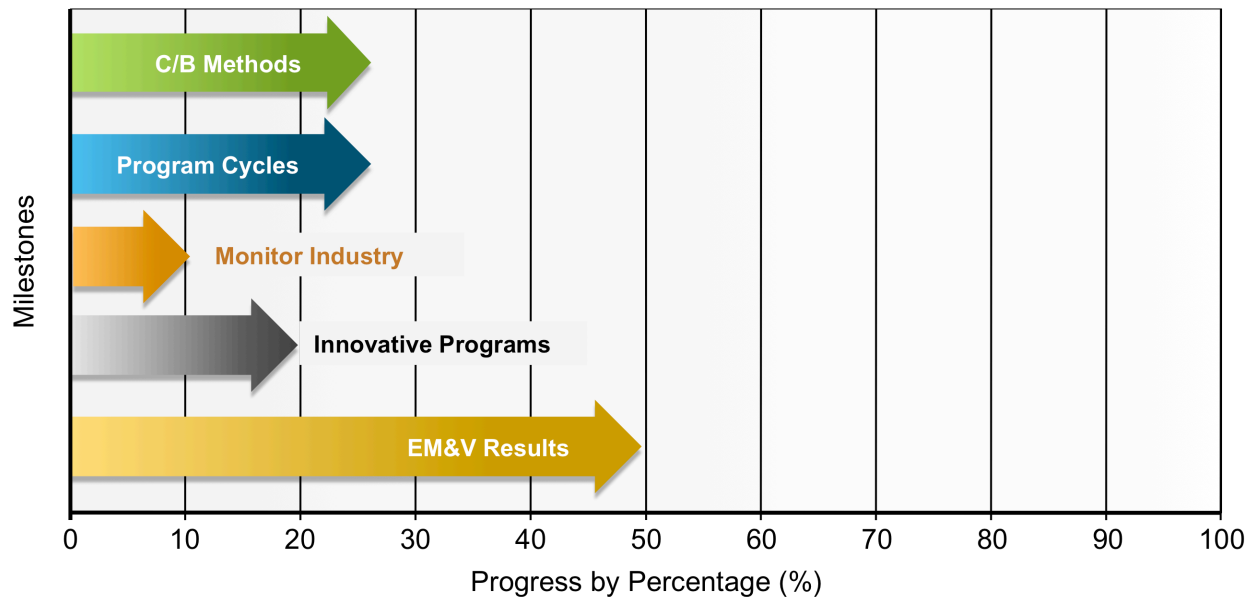
### STRATEGY 1-1: MATCH STATE LAWS, POLICY AND REGULATIONS WITH UTILITY ENERGY EFFICIENCY PROGRAM PRIORITIES AND STATEWIDE LIGHTING GOALS

To achieve the Strategic Plan’s over-arching vision for lighting, California must move swiftly to align and integrate policies that support and enable best practices. Currently, a patchwork of sometimes conflicting policies—including different methods used by the CPUC and the CEC to determine cost-effectiveness—limit adoption of best practices. Given the foundational role that state policies (especially Title 20 and Title 24) and utility incentives play in driving the transformation of the lighting market, the state must align regulations and investor-owned utility (IOU) portfolios. To make timely recommendations for the next utility program cycle (presumed 2014–2016)<sup>14</sup> and future Title 24 and Title 20 update processes, special attention must be paid to this strategy now.

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<sup>14</sup> The IOU energy efficiency program cycle is currently 2010–2012, to be followed by another three-year program cycle. However 1-2 year bridge funding is being considered, potentially pushing the next program cycle into 2014–2016.

## PROGRESS TO DATE (2010–2012)<sup>15</sup>



With proceedings underway at the CPUC related to milestones 1-1-1 and 1-1-2, approximately 25 percent of the actions needed to reach the Plan's near-term (2010–2012) milestones to evolve cost-effectiveness and program cycles are underway. While lacking progress on industry monitoring (10 percent), California has made progress with both innovative programs and policies (20 percent) and leveraging evaluation, measurement and verification (EM&V) results to improve policies (50 percent). For context, here are a few accomplishments on the path to integrating lighting policies around the state:

- **Assembly Bill (AB) 1109.**<sup>16</sup> The California Lighting Efficiency and Toxics Reduction Act ("Huffman") requires reductions in lighting energy use and a phase-out of inefficient, general-purpose light bulbs, as well as reduced mercury content and increased recycling. This legislation is intended to move California away from traditional incandescent lamps and toward more efficient and efficacious bulb types—a step toward achieving the Strategic Plan's lighting goals.
- **CPUC Decision (D) 09-09-047.**<sup>17</sup> In September 2009, the CPUC directed the IOUs to shift both funding and focus toward advanced lighting technologies within their residential lighting programs. This decision signaled a shift away from standard medium screw-base, spiral-style CFLs and toward more advanced technologies.

<sup>15</sup> "Progress by Percentage" divides the number of actions completed by the total number of actions to complete a milestone. Processes that are considered "ongoing" (such as updating codes) are listed as one-third complete in 2010, two-thirds in 2011 and three-thirds in 2012. These charts will be updated regularly on [www.Engage360.com](http://www.Engage360.com).

<sup>16</sup> California Lighting Efficiency and Toxics Reduction Act, AB 1109 (Huffman), Chapter 534. 2007. Accessed January 17, 2011, [http://www.leginfo.ca.gov/pub/07-08/bill/asm/ab\\_1101-1150/ab\\_1109\\_bill\\_20071012\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/07-08/bill/asm/ab_1101-1150/ab_1109_bill_20071012_chaptered.pdf).

<sup>17</sup> CPUC, 2009a. Decision Approving 2010-2012 Energy Efficiency Programs and Budgets (D09-09-047). Filed September 24, 2009, accessed January 17, 2011, [http://docs.cpuc.ca.gov/cyberdocs/webquickstart.asp?DOC\\_ID=400177&docType=LEGAL\\_PROCEED](http://docs.cpuc.ca.gov/cyberdocs/webquickstart.asp?DOC_ID=400177&docType=LEGAL_PROCEED).

- **Rulemaking 09-11-014.**<sup>18</sup> In the process of updating and establishing new energy savings goals for 2012 through 2020, several key issues—including consideration of four-year portfolio cycles, cost-effectiveness methodologies—are currently being addressed as part of providing guidance to the IOU portfolio development process.

## 1-1 ACTION PLAN (2010–2012)

Milestone	Champions	Key Actions	Timeline
<b>1-1-1</b> Explore implications of current cost/benefit methodologies on IOUs' ability to incorporate advanced lighting products into their programs	Mikhail Haramati, CPUC  Dina Mackin, CPUC	Initiate research implications of current cost-effectiveness methodology	Complete
		Review/test possible alternative methodologies	Q3 2011
		Engage industry stakeholders to select most promising changes (if any) to current methods	Q3 2011
		Propose/adopt changes (if any) for 2014–2016 programs	Q2 2012
<b>1-1-2</b> Explore implications of IOU program cycles on ability to reach lighting goals	Mikhail Haramati, CPUC  Brant Small, Lutron  Albertina Thai, PG&E	Initiate research on the implications of current program cycles	Complete
		Review summary of possible alternative scenarios and pros and cons	Q3 2011
		Engage industry stakeholders to finalize summary and select their preferred scenario	Q4 2011
		Develop guidance for 2014–2016 programs	Q1 2012
<b>1-1-3</b> Monitor lighting legislation/regulation and industry developments with the aim of incorporating additional lighting technologies and best practices into the next utility program cycle	Noah Horowitz, NRDC  Ted Pope, Energy Solutions	Identify people or organizations to track legislation/regulation/industry development	Q3 2011
		Develop criteria for tracking and information sharing (e.g., web portal, newsletter)	Q4 2011
		Review legislation/regulation/industry information	Ongoing
		Collaborate with champions from 1-1-2, 1-1-1, and 4-1-2; propose collaborative codes and standards recommendations	Q4 2011
		Apply findings to California's programs; create recommendations for 2014–2016 IOU program cycle	Q1 2012

<sup>18</sup> CPUC, 2009b. Order Instituting Rulemaking to Examine the Commission's Post-2008 Energy Efficiency Policies, Programs, Evaluation, Measurement, and Verification, and Related Issues (Rulemaking 09-11-014). Filed November 20, 2009, accessed January 17, 2011, <http://docs.cpuc.ca.gov/efile/CM/125338.pdf>.

Milestone	Champions	Key Actions	Timeline
<b>1-1-4</b> Design and test innovative program delivery strategies (e.g., IOU pilot program) to accelerate market transformation	Dave Bend, PG&E	Design trial studies and pilot programs to test innovative delivery strategy	Complete
	Bob King, Good Company	Launch trial studies and pilot programs	Q4 2011
		Initiate evaluations of trial studies and pilot programs	Q4 2011
		Review evaluation results	Q2 2012
	Vireak Ly, SCE Lela Manning, SDG&E	Propose/adopt changes (if any) to programs for next program cycle	Q4 2012
<b>1-1-5</b> Incorporate 2010–2012 EM&V results into policies and programs for future EE program cycles	Caroline Chen, SCE	Share 2006–2008 EM&V results with relevant agencies to inform policy and program direction	Complete
	Mikhail Haramati, CPUC	Measure and evaluate 2010–2012 programs	Ongoing
	Andrea Riemann, PG&E	Incorporate recommendations into policies and 2014–2016 programs	Q1 2012

## STRATEGY 1-2: BUILD A COMMON VISION FOR ADVANCING LIGHTING MARKET TRANSFORMATION AMONG KEY STATE AGENCIES

The vision and goals of the Strategic Plan's lighting chapter must gain traction throughout state agencies and the broader marketplace. While Strategy 1-1 focuses on creating and modifying state policies to support this vision, Strategy 1-2 ensures that state agencies have a common vision and agree on how to implement it. By actively building support for the transformed lighting market envisioned by the Plan, state agencies can more readily include energy efficient lighting in reach codes, education and outreach and a range of internal leadership opportunities, such as requiring best practices in all state buildings and properties. This effort will be launched in 2012 to build on the knowledge and progress achieved in Strategy 1-1's effort to align state policies, IOU programs and California's goals.

### 1-2 ACTION PLAN (2010–2012)

Milestone	Champions	Key Actions	Timeline
<b>1-2-1</b> Engage institutional stakeholders to collaborate on steps towards lighting market	TBD	Identify key institutions and stakeholders for collaboration including IOU lighting program staff and Commercial ZNE Action Plan champions	Q2 2012
		Coordinate with related Commercial ZNE Action Plan collaborative efforts (e.g., codes & standards)	Q2 2012

Milestone	Champions	Key Actions	Timeline
transformation and ZNE goals		Clarify intersection of lighting market transformation (LMT) and ZNE goals; develop a roadmap to enable ZNE lighting by 2030	Q3 2012
		Implement steps identified in roadmap	Q4 2012
<b>1-2-2</b> Align lighting-related codes & standards, green building rating system and industry norms and practices with ZNE policy	TBD	Coordinate with related ZNE Action Plan collaborative efforts (e.g., codes & standards)	Q2 2012
		Create a model building code that highlights best practice lighting	Q3 2012
		Evaluate T24 and T20 lighting elements; recommend ways to align with model code	Q3 2012
		Evaluate green building ratings (CALGreen, LEED) lighting elements; encourage better alignment with lighting best practices	Q4 2012
<b>1-2-3</b> Develop lighting standards for all public buildings to encourage leadership by example in support of ZNE goals	TBD	Review lighting standards for public buildings; assess level of good-better-best practices	Q1 2012
		Establish minimum standards for lighting and good-better-best practices	Q1 2012
		Launch outreach effort to promote lighting leadership in public buildings	Q2 2012

## STRATEGY 1-3: CREATE FINANCIAL INCENTIVES AND SUPPORTIVE POLICIES TO AVOID TRAPPED LIGHTING ENERGY SAVINGS OPPORTUNITIES AND MAKE BEST PRACTICE LIGHTING SOLUTIONS AFFORDABLE

The role of financing in energy efficiency is discussed throughout the Strategic Plan. Trapped savings—compounded losses in energy savings over time resulting from using standard practice lighting versus best practices—are often the result of inadequate policies and financial incentives to address first costs of best practice installations or renovations. Unfortunately, many new lighting installations and retrofits are typically comprised of least-cost components representing the minimum energy efficiency standards required by building codes. To avoid trapped savings, California must develop creative financial mechanisms that build on learnings from integrated demand-side management (IDSM) aggregated rebates, on-bill financing (OBF) and American Resource and Recovery Act (ARRA) funds. Lighting milestones related to financing are being addressed internally at the CPUC in 2011. To leverage limited resources, this part of the action plan will be launched in mid-2011 based on results of the CPUC's assessment.

## 1-3 ACTION PLAN (2010–2012)

Milestone	Champion	Key Actions	Timeline
<b>1-3-1</b> Identify and implement creative financing mechanisms, including those that reduce barriers to lifecycle investment strategies	TBD	Review and build on CPUC 2011 financing study (Due Q3 2011)	Q3 2011
		Develop gap analysis that specifies needs for lighting project financing	Q3 2011
		Prioritize effective financing options specific to lighting	Q1 2012
		Coordinate with Commercial ZNE Action Plan efforts to explore expanding financing	Q3 2012
		Present implementation recommendations for financing (e.g., 2014–2016 programs)	Q3 2012
<b>1-3-2</b> Identify and eliminate barriers to on-bill financing and incorporate third-party financing into IOU program offerings	TBD	Coordinate with Commercial ZNE Action Plan efforts to explore barriers to on-bill financing (OBF)	Q3 2011
		Identify highest potential for OBF expansion to achieve lighting goals	Q4 2011
		Recommend scenarios for OBF expansion in 2014–2016	Q1 2012
<b>1-3-3</b> Target statewide participation in AB 811-authorized financing mechanisms (such as Property Assessed Clean Energy [PACE] bonds)	TBD	Launch demo projects (e.g., Sonoma, Placer, Palm Desert via ARRA dollars)	Complete
		Track ongoing PACE and AB-811 funding updates	Ongoing
		Review evaluations demonstration projects; assess relevance for lighting	Q3 2011
		Create recommendations for 2014–2016 program cycle based on pilot/demo results	Q1 2012
<b>1-3-4</b> Advocate to raise percentage above T24 (including lighting) required to receive funding from California Solar Initiative (CSI) to 30%	TBD	Review current efficiency audit requirements for California Solar Initiative (CSI) program participation	Q3 2011
		Advocate for increasing percentage above T24 required to receive CSI funding	Q4 2011
		Explore how incentives from other utility programs can help fund lighting efficiency enhancements within CSI program requirements	Q2 2012

Milestone	Champion	Key Actions	Timeline
<b>1-3-5</b> Increasingly integrate funding for demand response, energy efficiency and renewable energy projects	TBD	Launch pilot programs to coordinated and expanded funding for integrated demand side management (IDSM) efforts	Complete
		Assess results of IDSM pilots, including streamlined applications for multiple technologies and graduated incentives	Q1 2012
		Create recommendations for 2014–2016 program cycle based on pilot results	Q1 2012

## STRATEGY 1-4: MINIMIZE ENVIRONMENTAL IMPACTS OF EACH LIGHTING TECHNOLOGY THROUGHOUT ITS LIFECYCLE (PRODUCTION, USE AND DISPOSAL)

In the Strategic Plan, California's vision of a transformed lighting market doesn't just include energy efficiency; the definition of best practices includes technologies that, "consistently achieve above standard results while avoiding negative environmental impacts."<sup>19</sup> Ensuring environmentally responsible production, use and disposal of the raw materials used to produce lighting products—including cadmium, chromium, lead and mercury—will prevent energy savings benefits from being off-set by ecological damage (thus resulting in net harm to the environment). Efforts to more aggressively pursue this strategy—including RD&D allocations, recycling, voluntary labeling and associating greenhouse gas (GHG) emissions reductions with lighting savings—will begin in the second half of 2011.

### 1-4 ACTION PLAN (2010–2012)

Milestone	Champion	Key Actions	Timeline
<b>1-4-1</b> Allocate research, demonstration and development (RD&D) funding to increase sustainability of best practice lighting systems and determine long range funding needs	TBD	Assess role that product sustainability plays in publically funded research (e.g., CEC's Public Interest Energy Research program)	Q3 2011
		Assess funding requirements and availability to develop and apply sustainability standards for lighting research and lighting products	Q4 2011
		Create and apply sustainability standards as requirements to introduce new lighting research and products into California	Q1 2012
<b>1-4-2</b> Develop cost-effective, convenient methods to collect and recycle any end-of-life lamps and test as pilot programs	TBD	Research Integrated Waste Management Board (IWMB) recycling regulations and requirements	Q1 2012
		Assess effectiveness of current recycling regulations and requirements with regard to achieving Strategic Plan goals	Q2 2012

<sup>19</sup> CPUC, 2010. Page 119.



Milestone	Champion	Key Actions	Timeline
		Create recommendations for IOU product recycling programs (2014–2016)	Q3 2012
		Determine needs for coordinated statewide lighting product recycling program	Q4 2012
<b>1-4-3</b> Establish hazardous materials content specifications for all lighting products in IOU programs	TBD	Partner with IWMB to develop hazardous materials limits for lighting technologies	Q3 2011
		Assess IOU policy with hazardous materials content and incentivized lighting	Q3 2011
		Recommend any necessary changes to IOU hazardous materials content limits for 2014–2016 programs	Q1 2012
		Implement revised hazardous material content limits	Q4 2012
<b>1-4-4</b> Develop and implement voluntary manufacturing and labeling standards that include sustainability indices	TBD	Explore existing labeling standards and programs to develop new standards	Q4 2011
		Run cost-benefit analysis of additional labeling standards	Q4 2011
		If appropriate, develop additional standards for issues not already addressed by existing activities	Q1 2012
<b>1-4-5</b> Incorporate measurement of avoided GHG emissions along with kW/kWh into EM&V activities/reports to encourage deeper energy savings <sup>20</sup>	TBD	Assess methodologies for extrapolating GHG savings from kWh/therm savings	Complete
		Determine correlation between use of GHG numbers and an increase in savings	Complete
		Determine appropriate GHG conversion factors (from kWh/therm savings)	Complete
		Require CPUC EM&V activities/reports to include data on avoided GHG emissions	Q1 2012
		Publicize results tying energy efficiency to avoided emissions	Q4 2012

<sup>20</sup> Impact evaluation reports for the 2006-2008 electric energy efficiency programs included electric power savings measured in kilowatt-hours (kWh) and peak demand reduction measured in kilowatts (kW).

## STRATEGY 1-5: COORDINATE PHASEOUT OF UTILITY INCENTIVES FOR PURCHASE OF CFLS

On the path to the Strategic Plan's 60–80 percent savings in lighting electrical energy use, California must clearly demarcate when a particular market or technology is “transformed” and at that point, shift dollars to other areas where more public intervention is need to further achieve the state's lighting objectives.<sup>21</sup> In addition to new state and federal lighting standards, funding for IOU-based incentive programs promoting basic CFLs has been decreased in 2010–2012 to help move in this direction. California will work with retailers and manufactures to help design the next set of energy efficient lighting technologies targeted for incentives and adoption and, ultimately, achieve market transformation. While the action plan will take these efforts up 2012, the IOUs are already monitoring sales as part of 2010–2012 program tracking efforts.

### 1-5 ACTION PLAN (2010–2012)

Milestone	Champion	Key Actions	Timeline
<b>1-5-1</b> Ensure that big box and home improvement retailers such as Wal-Mart and Home Depot are ready to stock Energy STAR price discounted CFLs in California as IOUs phase out CFL programs	TBD	Decrease availability of basic CFL incentives to big box and home improvement retailers	Complete
		Monitor CFL sales in the big box and home improvement retail channels to ensure no disproportionate effects	Ongoing
		Continue to decrease incentive levels and quantity of program discounted product in these channels until phased-out	Ongoing
<b>1-5-2</b> Utility engage in negotiations with manufacturers and retailers to buy-down prices and stock the next generation of high efficiency lighting	TBD	Convene utility representatives, manufacturers and retailers to discuss opportunities for next generation lighting program incentives	Q1 2012
		Establish incentive programs for the next generation of lighting best practices	Q1 2012

<sup>21</sup> In D09-09-047, the CPUC defines “market transformation” as follows: “Market transformation is long-lasting, sustainable changes in the structure or functioning of a market achieved by reducing barriers to the adoption of energy efficiency measures to the point where continuation of the same publicly-funded intervention is no longer appropriate in that specific market. Market transformation includes promoting one set of efficient technologies, processes or building design approaches until they are adopted into codes and standards (or otherwise substantially adopted by the market), while also moving forward to bring the next generation of even more efficient technologies, processes or design solutions to the market.” Page 89.

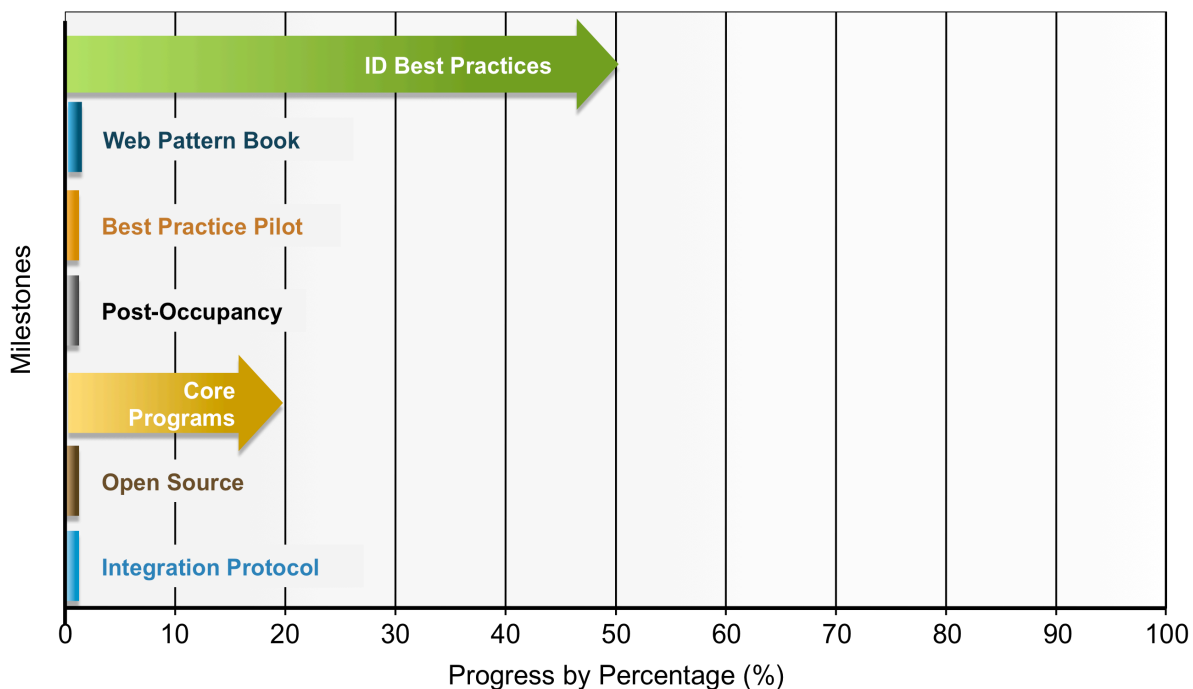
## GOAL 2: BEST PRACTICES

The following three strategies address Goal 2: “Define and advance best practices for design, installation, operation and maintenance of integrated systems to achieve sustainable lighting solutions for all spaces.”

### STRATEGY 2-1: IDENTIFY BEST PRACTICES IN COORDINATION WITH RD&D AND LIGHTING MARKET TRANSFORMATION PROGRAMS TO ENSURE USE OF HIGH-PERFORMANCE LIGHTING SYSTEMS

Best practice lighting is a key building block for the lighting chapter of the Strategic Plan (and ZNE buildings). Historically, the state’s multitude of research bodies (such as the CLTC, Lawrence Berkeley National Labs [LBNL], Electric Power Research Institute [EPRI] and the CEC’s Public Interest Energy Research [PIER] program) have not coordinated research around a unifying objective to accelerate best practices or market transformation. While the Plan puts forth a specific definition and the Lighting Technology Overview (see below) identifies priorities for the near-term implementation cycle (2010–2012), maximum savings will occur if California coordinates both privately and publically funded RD&D with lighting market transformation programs (which elevate best practices) to focus the marketplace and to ensure the availability and use of best practices. As with Goal 1, this strategy establishes a framework for statewide coordination and is thus a high priority for immediate implementation.

#### PROGRESS TO DATE (2010–2012)



With the publication of the Lighting Technology Overview (see bullet below) significant progress (50 percent) has been made in the identification of best practices. Finding ways increase best practices in core programs has launched (20 percent), but developing web-based pattern books, pilot projects, post-occupancy evaluation and open source protocols appear to have little progress (zero percent) are still in

the beginning stages. Once this action plan is launched (mid-2011), we expect to see swift advancement in milestones. Examples of progress include:

- **Lighting Technology Overview (LTO).**<sup>22</sup> Updated in 2010, the LTO is the first consolidated source of best practice lighting solutions for multiple market sectors (including their technical potential and barriers currently facing their adoption) and has established a path to identify best practices.
- **T24 Residential Lighting Design Guide<sup>23</sup> and Advanced Lighting Guidelines.**<sup>24</sup> The Design Guide outlines best practices in lighting design to help builders comply with California's 2008 Title 24 energy code requirements. The 2010 Advanced Lighting Guidelines—a staple of lighting professionals' tool kits, including research, current technologies and best-practice design strategies—includes updated material and launch as a new electronic version: ALG Online.
- **The California Advanced Lighting Controls Training Program (CALCTP).**<sup>25</sup> CALCTP is uniquely focused on increasing the use of lighting controls—a crucial shift to ensure success of the Strategic Plan. CALCTP is training and certifying licensed electrical contractors and state-certified general electricians in the proper design, installation and commissioning of, advanced lighting control systems.
- **Open Source Lighting Protocols.**<sup>26</sup> There are a number of efforts to develop both hardwired and wireless open source protocols for lighting, which will greatly reduce initial costs associated with retrofitting buildings with lighting controls and enable widespread adoption by 2020. A number of efforts are in progress with the National Electrical Manufacturers Association (NEMA), Zigbee Alliance and others.<sup>27</sup>

## 2-1 ACTION PLAN (2010–2012)

Milestone	Champions	Key Actions	Timeline
<b>2-1-1</b> Identify top best practices for major space types and customer segments (including residential low income); achieve	Dustin Davis, CEC	Establish and implement a plan for identifying best practices	Complete
	Zach Gentry	Identify space types and customer segments to focus on	Complete
		Identify top best practices for prioritized space types and customer segments	Complete
		Assess market potential for best	Q3 2011

<sup>22</sup> CLTC, 2010. 2010 Lighting Technology Overviews and Best-Practice Lighting Solutions. Prepared for the CPUC. Accessed January 17, 2011, [http://uc-ciee.org/buildings/documents/2010\\_LTO\\_082010.pdf](http://uc-ciee.org/buildings/documents/2010_LTO_082010.pdf).

<sup>23</sup> CLTC, 2008. Title 24 Residential Lighting Design Guide: Best practices and Lighting Designs to Help Builders Comply with California's 2008 Title 24 Building Energy Efficiency Standards. Accessed January 17, 2011, [http://cltc.ucdavis.edu/images/documents/guides\\_reports/title24/Title24\\_Residential\\_Lighting\\_Design\\_Guide\\_2008.pdf](http://cltc.ucdavis.edu/images/documents/guides_reports/title24/Title24_Residential_Lighting_Design_Guide_2008.pdf).

<sup>24</sup> "Welcome to Advanced Lighting Guidelines," accessed January 17, 2011, <http://www.algonline.org/>.

<sup>25</sup> "California Advanced Lighting Controls Training Program," accessed January 17, 2011, <http://www.calctcp.org/>.

<sup>26</sup> One technical challenge for best practice lighting systems is to provide building occupants with personal control of multi-luminaire, centralized lighting systems given that each component manufacturer uses its own digital communications protocols. There are currently no protocols that apply to all components in a lighting system regardless of manufacturer. Standardization and open-sourcing (making the programming code freely available) will allow compatibility among lighting components offered by multiple manufacturers.

<sup>27</sup> For more information on these activities, visit NEMA's website at <http://www.nema.org/stds/lsd53.cfm> and the Zigbee Alliance website at <http://www.zigbee.org/>.

Milestone	Champions	Key Actions	Timeline
50% of the potential savings identified		practices by market sector/segment	Q3 2011
		Develop plan to achieve at least 50% of potential identified savings (including utility programs)	Q3 2011
		Implement plan and track accumulated savings	Q3 2011
<b>2-1-2</b> Create web-based pattern books for market segments that represent at least 60% of the total lighting use	Kelly Cunningham, CLTC	Conduct gap analysis of existing pattern books (or similar tools) to determine needs	Q3 2011
	Barbara Hamilton, New Buildings Institute (NBI)	Conduct gap analysis of existing pattern books (or similar tools) to determine needs	Q3 2011
		Identify market segments that represent 50% of total lighting use	Q4 2011
		Test online pattern books; recommend updates to relevant organizations	Q2 2012
		Leverage affinity websites to promote online pattern books	Q4 2012
<b>2-1-3</b> Develop pilot projects that support best practices	Doug Avery, SCE	Identify additional technologies in need of pilot program testing (see 1-1-4)	Q3 2011
	Peter Turnbull, PG&E	Assess intersection of existing IOU pilot programs and best practices	Q3 2011
		Identify process to refine technologies in IOUs' LMT Program Implementation Plan	Q3 2011
	Dirk Van Ulden, University of California Office of the President	Conduct early evaluation of pilot programs	Q1 2012
		Incorporate successful pilots into IOU core (fully funded) programs for 2014–2016	Q1 2012
<b>2-1-4</b> Initiate post-occupancy evaluation of 5% of permitted and/or incentivized lighting installations	Owen Howlett, Heschong Mahone Group	Identify appropriate pre/post attributes to measure (e.g., energy use, photometric performance, satisfaction)	Q3 2011
	Francis Rubinstein, LBNL	Identify procedures to assess these attributes	Q4 2011
		Develop process for accumulating evaluative data and populating database of measured performance	Q2 2012
		Identify 5% of installations proposed for evaluation	Q3 2012

Milestone	Champions	Key Actions	Timeline
<b>2-1-5</b> Integrate best practices with core utility programs and ensure use in at least 50% of new projects	Mikhail Haramati, CPUC	Identify lighting best practices to be incorporated into core IOU programs	Complete
	Winsey Kan, PG&E	Rank each potential best practice for feasibility for incorporating into core programs; select most appropriate	Q3 2011
	Vireak Ly, SCE	Review process for adding new measures to utility programs during a program cycle or at the beginning of a new cycle	Q4 2011
		Begin to incorporate best practice technologies and systems into core programs	Q1 2012
		In 2012, include at least one best practice measure in at least half of applicable IOU program projects <sup>28</sup>	Q4 2012
<b>2-1-6</b> Incorporate open source lighting communications protocols into best practices, incentives and codes	Robert Erhardt, Philips Lighting Electronics NA	Collect and document information on all available open source lighting protocols	Q3 2011
	Robert Hick, Leviton Lighting and Energy Solutions	Assess applications best suited to each protocol	Q4 2011
		Incorporate protocols into ongoing process for identifying best practices in lighting	Q1 2012
		Incorporate open source protocols into utility programs	Q1 2012
		Incorporate protocols into statewide codes and standards (2014)	Q4 2012
<b>2-1-7</b> Establish integration protocols for lighting systems with all building systems, smart grid, monitoring and commissioning systems used in the public sector	Robert Erhardt, Philips Lighting Electronics NA	Launch needs assessment for lighting integration protocols to enable ZNE	Q3 2011
	Robert Hick, Leviton Lighting and Energy Solutions	Identify key entities for coordination (e.g., ZNE Action Plan, open source champs 2-1-6, etc.)	Q4 2011
		Determine best path to implementation (e.g., codes and standards, IOUs and rebates, etc.)	Q1 2012
		Implement and enforce integration protocols in public sector (state buildings)	Q4 2012

<sup>28</sup> In this context, a “project” is a signed application or customer authorized form for measure installation, and “applicable” refers to projects for which a lighting best practice is an option for installation.

## STRATEGY 2-2: ELEVATE THE LEVEL OF PROFESSIONAL PRACTICE AND PERFORMANCE FOR DESIGNERS, ARCHITECTURAL CONSULTANTS, ELECTRIC CONTRACTORS, ENGINEERS AND OTHER LIGHTING PROFESSIONALS

The Strategic Plan's goals require substantial enhancements to workforce education and training (WE&T). With few organizations offering certification for the proper design, specification, installation and maintenance of best practice lighting—such as the National Council on Qualifications for the Lighting Professions (NCQLP)'s program for Lighting Certified Professionals<sup>29</sup>—the majority of all lighting installations are “status quo” (and use roughly twice as much electricity as the associated best practice installation). With a strong correlation between energy savings and highly trained lighting professionals,<sup>30</sup> California must include best practices lighting specifications with WE&T programs and green ratings systems. In particular, WE&T efforts should emphasize the need for integrated system design. This strategy will be pursued in mid-2011 to leverage and build on the early success of CALCTP (see Strategy 2-1, above).

### 2-2 ACTION PLAN (2010–2012)

Milestone	Champions	Key Actions	Timeline
<b>2-2-1</b> Develop specifications for 2020 lighting best practices by market sector for highest end-uses in coordination w/RD&D	TBD	Identify “highest end uses” market sector for specification development	Q3 2011
		Convene RD&D group and stakeholders to agree on vision for 2020 lighting best practices	Q3 2011
		Scope specifications that fulfill vision for 2020 lighting best practices	Q4 2011
		Create 2020 specification roadmap that outlines process and benchmarks to get to 2020 vision	Q4 2011
<b>2-2-2</b> Educate and train lighting professionals on evolving best practices and how best to explain their benefits to end users	TBD	Review existing professional training programs on best lighting practices (including training offered by the utilities, lighting professional organizations, <i>et al.</i> )	Q4 2011
		Coordinate/leverage existing efforts and develop additional best practices curriculum as needed	Q1 2012
		Conduct best practices training; track participation and correlation between training	Q1 2012

<sup>29</sup> For more details, visit the NCQLP's website at <http://www.ncqlp.org/>.

<sup>30</sup> See, e.g., “Efficiency Vermont's RELIGHT Lighting Design Program Fact Sheet” ([http://www.efficiencyvermont.com/stella/filelib/RELIGHT\\_FactSheet\\_FINAL.pdf](http://www.efficiencyvermont.com/stella/filelib/RELIGHT_FactSheet_FINAL.pdf)) which suggests that involving lighting designers in lighting upgrade projects increased energy savings by an average of 40 percent compared to standard retrofits.



Milestone	Champions	Key Actions	Timeline
		and best practices new installations/retrofits	
		Explore ways to incorporate curriculum into web-based training and/or college/university programs	Q2 2012
<b>2-2-3</b> Require Lighting Certification for designers and contractors who implement public agency installations/ retrofits; encourage 30% of private sector projects to require certification	TBD	Identify certification systems aligned with best practices	Q4 2011
		Assess procedure to change requirements for lighting installations in public agency buildings	Q1 2012
		Establish lighting certification as prerequisite for state contracts	Q2 2012
		Partner with key organizations (e.g., Building Owners and Managers Association [BOMA]) to encourage same policies in private sector	Q2 2012
		Track state projects conducted by Lighting Certified professionals and publicize results	Q3 2012
<b>2-2-4</b> Ensure understanding and application of lighting system integration protocols for lighting professionals	TBD	Leverage efforts related to milestones 2-1-6 and 2-1-7 to develop protocols	Q1 2012
		Develop training module regarding integration protocols	Q2 2012
		Leverage efforts of milestone 2-2-2 to integrate module into lighting training for professionals	Q3 2012

## STRATEGY 2-3: CONTINUOUSLY PROMOTE LIGHTING SYSTEM DESIGN IMPROVEMENTS TO CODES AND STANDARDS BASED ON THE BEST AVAILABLE FIELD DATA AND STUDIES

Codes and standards (C&S) are among the most powerful tools in California's energy efficiency arsenal, and is part of nearly every chapter of the Strategic Plan. Best practices must be promoted into C&S—both voluntary (reach) and mandatory—to ensure widespread adoption throughout California. However, California's appliance and building codes are incremental (e.g., Title 24 is based on a 3-year cycle) and at odds with the need to quickly elevate best practices. To ensure that best practice lighting technologies and systems can be quickly incorporated into codes, this strategy galvanizes efforts surrounding C&S by leveraging best practices in the field (including the private sector) to provide additional sources of case studies and data. Milestone activity for this strategy will begin in late 2011 to leverage the near-term code updating process and best prepare for the next the Title 24 code update process beginning in 2014.



## 2-3 ACTION PLAN (2010–2012)

Milestone	Champions	Key Actions	Timeline
<b>2-3-1</b> Explore opportunities to enhance and accelerate process for integrating best practices into codes (T20 and T24) and code enforcement	TBD	Coordinate with ZNE Action Plan champions, including CEC codes and standards staff	Q3 2011
		Engage industry stakeholders in assessing the profile of best practices lighting reach codes (e.g., CALGreen)	Q3 2011
		Propose/adopt best practice lighting technologies and systems into codes and standards on an ongoing basis	Q2 2011
<b>2-3-2</b> Develop an integrated benchmarking process that enables accounting of lighting savings and encourage 50% of California's major lighting end users to benchmark	TBD	Assess existing California benchmarking processes (ENERGY STAR, Building Energy Asset Rating [BEARS] <sup>31</sup> ) to address best practices lighting/savings	Q3 2011
		Identify gaps in existing benchmarking efforts to address key end uses (work with ZNE Action Plan)	Q3 2011
		Prioritize best tools and processes to benchmark lighting efforts	Q3 2011
		Develop outreach campaign for major lighting end users in California	Q3 2011
		Track results for benchmarking efforts and publicize participation results	Q4 2011
<b>2-3-3</b> Create a standard lifecycle evaluation for lighting impacts, including savings calculation template with kW, kWh, Therms, CO <sub>2</sub> and funding sources	TBD	Review existing standard, including funding sources (payback, first costs)	Q2 2012
		Modify standard into something to be used for broader lighting industry	Q3 2012
		Launch communications effort and technical instruction/assistance including lifecycle evaluation in lighting	Q3 2012
		Launch outreach effort to encourage use of lifecycle evaluation in lighting	Q4 2012

<sup>31</sup> BEARS is an asset rating tool being developed in conjunction with AB 758 implementation to assist in achieving energy savings in the existing building stock in California.

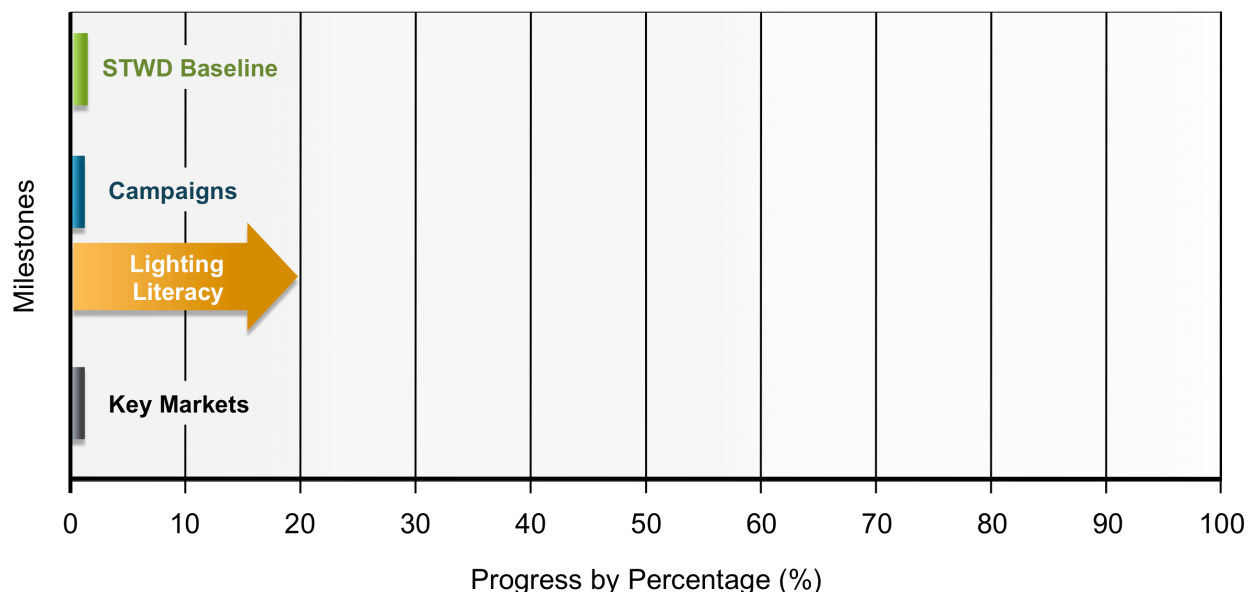
## GOAL 3: END USER DEMAND

The following three strategies address Goal 3: “Define and advance best practices for design, installation, operation and maintenance of integrated systems to achieve sustainable lighting solutions for all spaces.”

### STRATEGY 3-1: EDUCATE CALIFORNIANS TO EQUATE QUALITY OF LIGHT WITH QUALITY OF LIFE

Achieving a 60–80 percent reduction in lighting electrical energy use requires more than just “push” from policy; it requires a “pull” from Californians who fundamentally value energy efficient lighting and its benefits. As detailed in the Strategic Plan, consumer demand will also change as end users develop lighting literacy (through education from schools or local governments) and understand how quality of light affects quality of life (health and performance). Communications must be developed to educate Californians about the very real, personal benefits resulting from best practice lighting. Behavior does not change overnight; to have the best chance of success, education activities must begin immediately and infuse all aspects of the 2010–2012 lighting programs and marketing and outreach campaigns.

#### PROGRESS TO DATE (2010–2012)



Given the very recent publication of the lighting chapter of the Strategic Plan, little has been accomplished on specific tasks in the action plan surrounding education and outreach. Currently most action plan milestones for Goal 3 are tracking to zero, with the exception of research done to initiate the statewide baseline (20 percent). We anticipate great gains will be reflected in the progress of the action plan by mid-2011. Some parallel efforts that reflect progress in the broader marketplace include:

- **Lighting Understanding for a More Efficient Nation (LUMEN) Coalition.** To address the need to educate the general public regarding both the existence of and the impacts of the pending Energy Independence and Security Act of 2007 (EISA 2007) legislation, a group of individuals and lighting

organizations have formed the LUMEN Coalition to facilitate consumer education regarding energy-energy lighting decisions.<sup>32</sup>

- **University of California at Davis (UC Davis) Smart Lighting Initiative.** UC Davis is the first large institution to commit to a sweeping cut in energy use in response to the Strategic Plans' goals to transform the lighting market and achieve a 60–80 percent reduction in statewide electrical lighting energy consumption. Frequent communications about progress will help transform not only the way students and faculty at UC Davis think about lighting, but the broader population as well.
- **U.S. DOE Energy Literacy Initiative.** To better educate Americans, ELI is defining and promoting energy literacy. Launched in early 2011, ELI's goal is to compile a set of national standards for energy literacy, used to improve understanding of energy sources, generation, use and conservation.<sup>33</sup>
- **Federal Trade Commission "Lighting Facts" Label.** In support of the 2012 phase out of incandescents, the FTC has mandated that bulb packaging emphasize brightness measured in lumens as opposed to watts (energy use). The Lighting Facts label will include brightness, estimated yearly energy cost, bulb life expectancy, light appearance (from warm to cool) and if the bulb contains mercury—all important factors in changing the ways Californians consume lighting.

### 3-1 ACTION PLAN (2010–2012)

Milestone	Champion	Key Actions	Timeline
<b>3-1-1</b> Institute a statewide baseline study to assess end user wants and needs related to lighting as well as their satisfaction with current lighting technologies and systems	Caroline Chen, SCE	Initiate literature review to identify baseline studies and research on lighting preferences, motivators, etc.	Q3 2011
	Kelly Cunningham, CLTC	Convene lighting and market research experts to review existing body of work and additional baseline study needs	Q3 2011
	Kevin McKinley, SDG&E	Compile and share results of available studies regarding lighting end-user wants, needs and satisfaction	Q4 2012
	Andrea Riemann, PG&E		
<b>3-1-2</b> Create relevant campaigns and messages for each market segment (including residential low income)	Peter Banwell, EPA	Identify key market segments toward which messages will be targeted	Q3 2011
	Alice Liddell, ICF International	Develop key messages and audience segmentation guide	Q3 2011
		Identify key bodies for collaboration on outreach	Q3 2011
		Publish messages and audience guide online for public use	Q3 2011

<sup>32</sup> For more information, please go to [http://www.ies.org/PDF/PublicPolicy/LUMEN-Organization-Charter\\_Members.PDF](http://www.ies.org/PDF/PublicPolicy/LUMEN-Organization-Charter_Members.PDF)

<sup>33</sup> More information is available at [DOE's Energy Literacy wiki](#)

Milestone	Champion	Key Actions	Timeline
<b>3-1-3</b> Initiate lighting literacy education to the public via local governments, schools, etc.	Vanessa Byrd, CEC	Convene lighting and education experts to assess existing energy efficiency curricula	Complete
	Michael Lindsey, IALD, Horton Lees Brogden Lighting Design	Develop supplements as necessary and as in line with state schools process	Q4 2011
	Jim Ogden, Chair of the CHPS Technical Committee	Publish curricula in print guides and online	Q1 2012
		Advertise availability of lighting-related curricula to targeted groups	Q1 2012
		Assist targeted groups in disseminating curricula	Q2 2012
<b>3-1-4</b> Explore options for marketing campaigns targeting key outlets (including social media, retail displays, lighting show, etc.)	Juan Carlos, Blacker	Inventory existing campaigns and activities	Q3 2011
	Jennifer Lawrence, CREE	In collaboration with lighting and marketing experts, develop list of additional campaign options to fill gaps	Q4 2011
	Thor Scordelis, Xicato	Research viability of each option listed	Q2 2012
		Publish recommended marketing approaches in an online guide for key outlets	Q3 2012

## STRATEGY 3-2: LEVERAGE KEY MARKET STAKEHOLDERS ALONG THE ENTIRE LIGHTING VALUE CHAIN TO PROMOTE ADVANCED LIGHTING TECHNOLOGIES AND BEST PRACTICES

Recent studies published by the CPUC conclude that awareness of energy savings benefits alone does not lead to changes in attitudes, beliefs, habits and/or practices.<sup>34</sup> To achieve the goals of the Strategic Plan, unified efforts must be made to break down barriers (perceived or actual) to adopting best practices; doing this will require unified messages and coordinated education and outreach through governments, nonprofits, industry organizations, retailers and others. While many of the necessary activities are already underway, champions for this effort will be secured in late 2011 or early 2012. Next steps will build on progress made with the educational efforts detailed in 3-1 above.

<sup>34</sup> See, e.g., Opinion Dynamics Corporation, 2009. Ethnographic Research Findings. Accessed January 17, 2011, <http://www.cpuc.ca.gov/NR/rdonlyres/3D5AC333-D531-4734-AF9D-1A28AF7E5008/0/FinalEthnographicResearchPresentation.pdf>.

### 3-2 ACTION PLAN (2010–2012)

Milestone	Champion	Key Actions	Timeline
<b>3-2-1</b> Develop partnerships with lighting influencers to coordinate promotion of priority technologies	TBD	Convene group of lighting stakeholders to identify set of 2010 lighting best practices	Complete
		Publish list of best practices in print and online	Complete
		Work with lighting stakeholders to promote lighting best practices	Ongoing
<b>3-2-2</b> Work with IOUs to leverage customer service teams and ensure efficient lamps are installed, not stored	TBD	Develop campaign to educate end users regarding the benefits of immediate installation (rather than storage) of energy efficient lamps	Q2 2012
		Launch campaign and monitor progress	Q3 2012
<b>3-2-3</b> Launch grassroots efforts with corporate green teams and local environmental groups to influence lighting leadership	TBD	Generate list of target organizations (in coordination with strategy 3-1)	Q3 2011
		Establish partnerships with organizations	Q4 2011
		Collaborate with partner organizations to generate strategies for influencing lighting leadership	Ongoing
		Implement strategies	Ongoing
<b>3-2-4</b> Elevate the role of lighting in green building rating systems (e.g., Leadership in Energy and Environmental Design [LEED])	TBD	Inventory relevant building ratings systems that should improve attention to lighting	Q4 2011
		Convene meeting with U.S. Green Buildings Council (USGBC) and other rating organizations to address best practices lighting	Q1 2012
		Identify set of key strategies for elevating role of lighting for each rating system	Q1 2012
		Work with rating systems to include best practice lighting solutions in certifications	Q2 2012
<b>3-2-5</b> Work with industry on tenant improvement packages (link to high-quality advanced lighting)	TBD	Identify key entities (e.g., BOMA) with which to partner	Q1 2012
		Convene lighting designers, property managers to identify tenant improvement practices for specific space types	Q2 2012
		Promote tenant improvement packages	Q3 2012

## STRATEGY 3-3: EDUCATE DECISION MAKERS ABOUT CREATIVE FINANCIAL MECHANISMS THAT ENABLE PURCHASE OF ADVANCED LIGHTING TECHNOLOGIES, SYSTEMS AND USE BEST PRACTICES

First costs and payback periods are often cited as the biggest obstacles in path to achieve the Strategic Plan's lighting goals. However, financial barriers can be addressed through creative strategies such as group purchasing arrangements to leverage the purchasing power of multiple businesses, enabling each entity to obtain lighting equipment at lower prices than if they were to purchase the equipment individually. Financing is a vital element to realizing the goals of the Strategic Plan and is being addressed internally at the CPUC. However, several other strategies—such as group purchasing—can be pursued in parallel to address financial barriers posed by best practice lighting. To leverage the CPUC's assessment, this action plan will address financial milestones toward the end of 2011.

### 3-3 ACTION PLAN (2010–2012)

Milestone	Champion	Key Actions	Timeline
<b>3-3-1</b> Explore barriers to sale/purchase/ installation of best practice lighting technologies systems	TBD	Identify “most likely to succeed” best practices (from 2010 LTO) for near-term studies	Q3 2011
		Conduct study to examine barriers in specific markets to the sale/purchase of best practices (coordinate with 3-1-2)	Q3 2012
<b>3-3-2</b> Create and publicize cooperative guides that inventory all financing options related to best practice lighting solutions	TBD	Conduct inventory of financing options by market sector	Q1 2012
		Publish financing guides in print and online	Q2 2012
		Publicize and circulate financing guides among end users via relevant organizations and outlets	Q2 2012
<b>3-3-3</b> Create education and outreach partnerships with lenders focused on financing energy efficient lighting projects	TBD	Identify lenders focused on or open to financing energy efficient lighting projects	Q1 2012
		Convene group of lighting and lending experts to discuss opportunities for energy efficient lighting project financing	Q1 2012
		Incorporate findings into financing guides developed as part of milestone 3-3-2	Q2 2012
<b>3-3-4</b> Facilitate group purchasing orders for large institutions	TBD	Identify technologies suitable for group purchasing arrangements	Q2 2012
		Establish list of large institutions and inventory their lighting needs	Q3 2012
		Develop specifications for group purchases	Q3 2012
		Negotiate with lighting vendors to obtain discounts for bulk purchase of lighting	Q4 2012

		equipment for multiple end users	
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## STRATEGY 3-4: INTRODUCE ADVANCED LIGHTING TECHNOLOGIES, SYSTEMS AND BEST PRACTICES INTO THE MARKETPLACE WITH PROGRESSIVE GOALS

Simply making best practice lighting technologies available to contractors or in retail stores will not ensure adoption and use. In keeping with the Strategic Plan's focus on market diffusion theory, new technologies must be introduced to the market in ways that effectively increase the speed at which end users adopt them, moving quickly from innovators and early adopters to early majorities and beyond. As demonstrated by successes in other technology sectors (e.g., personal computers), best practice lighting strategies cannot end with a product on a shelf. Instead, this action plan must include timely market introductions and ways to take advantage of transition points for end users (e.g., changes in building ownership, remodeling projects), and not only accelerate adoption, but free public funds and private focus to develop the next generation of best practice lighting solutions. These efforts will begin in 2012 to best inform approaches for 2014–2016 pilot programs and lighting market transformation efforts.

### 3-4 ACTION PLAN (2010-2012)

Milestone	Champion	Key Actions	Timeline
<b>3-4-1</b> Study product introductions from other industries to inform strategies for lighting technology introductions	TBD	Conduct literature review of case studies regarding product introductions in other industries (both successful and unsuccessful)	Q1 2012
		Assemble set of best strategies for technology introductions	Q2 2012
		Disseminate and promulgate best strategies for lighting product introduction	Q3 2012
<b>3-4-2</b> Conduct a lighting transition/ intervention points study (segmented by building type); use results to accelerate best practice adoption	TBD	Determine relevant set of building types	Q1 2012
		Design and implement study to assess intervention points in each building type	Q2 2012
		Publish and disseminate study results	Q3 2012
		Encourage lighting professionals to use study results to accelerate adoption of best practices	Q4 2012
<b>3-4-3</b> Research and propose business case for best practice lighting (including GHG offsets) to Corporate Financial Officers and other key decision makers	TBD	Conduct a literature review and gap analysis of best practices for developing business cases for technology adoption	Q1 2012
		Conduct research to fill gaps identified in literature review	Q2 2012
		Publish and disseminate strategies for pitching business case for best practice lighting to lighting professionals	Q3 2012





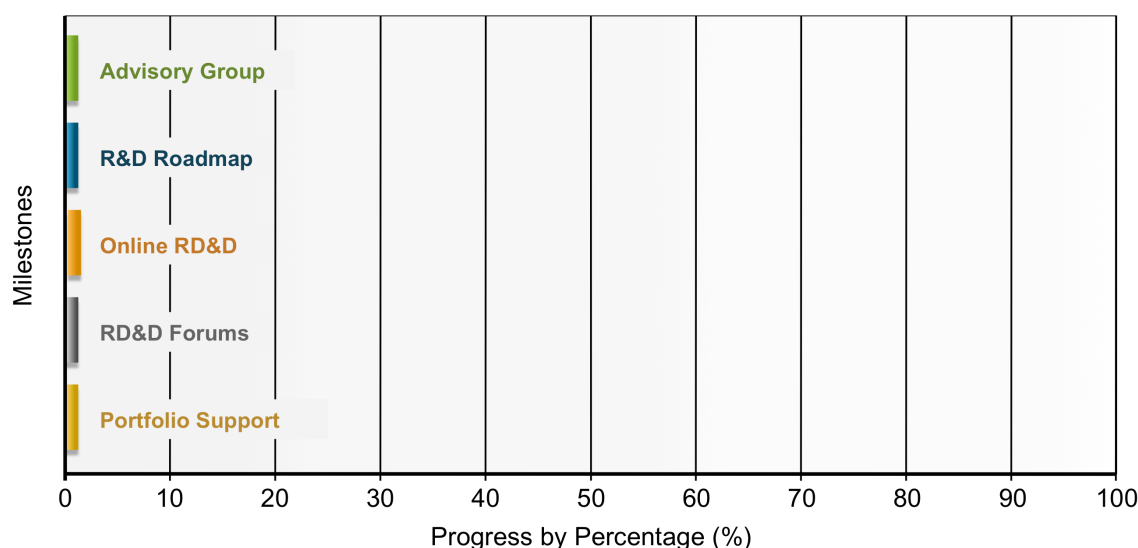
## GOAL 4: RESEARCH, DEVELOPMENT AND DEMONSTRATION

The following strategies are focused on initiatives to achieve Goal 4: “Develop RD&D networks to create, test and deliver the lighting solutions needed to transform California’s lighting market achieve ZNE goals.”

### STRATEGY 4-1: ESTABLISH AND MAINTAIN A RESEARCH-BASED COLLABORATIVE, MULTI-INSTITUTIONAL STATEWIDE LIGHTING RD&D APPROACH

To achieve the Strategic Plan’s lighting goals, collaborative RD&D that coordinates research directed towards lighting market transformation efforts is essential. As stated in the Strategic Plan, RD&D must “focus on rapid market transformation instead of slow, incremental technological advances.”<sup>35</sup> Among the first objectives in this effort, leaders from across the industry—including marketing, education, research, manufacturing and retail professionals—will draft California’s first lighting RD&D roadmap for the next 10 years. Like other priority strategies in this action plan, these efforts to galvanize the industry must start immediately and accelerate progress quickly.

#### PROGRESS TO DATE (2010–2012)



Given the very recent publication of the lighting chapter of the Strategic Plan, there is much to be accomplished on specific tasks in the action plan to create a more collaborative approach to lighting RD&D. As such, all Goal 4 milestones are currently estimated at zero percent. However, we anticipate great gains will be reflected in the progress of the action plan in 2011. Some parallel efforts that reflect progress in the broader marketplace include:

<sup>35</sup> CPUC, 2010. Page 110.

- **U.S. DOE Solid State Lighting (SSL) Research and Development: Manufacturing Roadmap.**<sup>36</sup> A product and process the California can leverage, the U.S. DOE's roadmap includes core technology research, product development and a new SSL manufacturing initiative to accelerate adoption through manufacturing improvements that reduce costs and enhance quality.
- **Northwest Energy Efficiency Technology Roadmap.**<sup>37</sup> The Bonneville Power Administration (BPA) has placed a renewed emphasis on RD&D and has developed this roadmap maximum benefit from RD&D. The BPA example provides an instructive model for California, including both visual references and detailed accounting of actors in lighting RD&D.

## 4-1 ACTION PLAN (2010–2012)

Milestone	Champion	Key Actions	Timeline
<b>4-1-1</b> Establish a lighting RD&D advisory group with relevant subgroups to provide long-term guidance to California in the lighting efficiency and sustainability arenas	Connie Samla, SMUD	Identify and recruit organizations and individuals for advisory group	Q3 2011
	Michael Siminovtich, CLTC	Establish meeting calendar for the year, including key objectives and milestones for 2010–2012	Q3 2011
	Alan Suileman, SMUD		
<b>4-1-2</b> Publish California's first statewide multi-institutional lighting RD&D roadmap	Gregg Ander, SCE	Convene meeting of advisory group to identify necessary elements of roadmap	Q4 2011
	Dave Bend, PG&E	Develop preliminary roadmap content	Q4 2011
		Establish and agree upon metrics to measure progress within roadmap steps	Q4 2011
	Connie Samla, SMUD	Review, finalize, publish, and promote roadmap	Q1 2012
	Alan Suileman, SMUD	Track progress; publicize results	Q3 2012

<sup>36</sup> U.S. DOE, 2009. Solid-State Lighting Research and Development: Manufacturing Roadmap. Last modified September 2009, accessed January 17, 2011, [http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl-manufacturing-roadmap\\_09-09.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl-manufacturing-roadmap_09-09.pdf).

<sup>37</sup> BPA, 2001. Northwest Energy Efficiency Technology Roadmap. Last modified July 2010; accessed January 17, 2011, <http://www.bpa.gov/corporate/business/innovation/docs/2010/NW%20Energy%20Efficiency%20Technology%20Roadmap%20March%202010.pdf>.

Milestone	Champion	Key Actions	Timeline
<b>4-1-3</b> Establish an online resource (integrated with the CPUC web portal) to assist disseminating RD&D solutions and demonstration outcomes	Kelly Cunningham, CLTC	Secure hosting commitment from appropriate web host (e.g., CLTC Lighting Portal <sup>38</sup> )	Complete
	Dustin Davis, CEC	Identify and/or develop appropriate content and formatting	Q3 2011
		Launch website and publicize	Q4 2011
<b>4-1-4</b> Develop ongoing RD&D forums and workshops to assist in disseminating solutions and demonstration outcomes	Peter Schwartz, Lum Energy	Inventory existing forums and leverage collaboration to craft RD&D workshop topics	Q3 2011
	Michael Seaman, Seaman Consulting	Develop workshop objectives and content in coordination with ongoing IOU and state efforts	Q3 2011
	Randy Wong, PG&E	Plan, publicize, and hold RD&D workshops	Q4 2011
		Track workshop participation; publicize key outcomes	Q4 2011
<b>4-1-5</b> Establish broad support and funding for RD&D portfolio	Mark Boomgaarden, Lighting Science Group	Scope work and funding needs to launch annual RD&D portfolio and roadmap	Q3 2011
	Alex Bosenberg, NEMA	Convene RD&D group and relevant stakeholders to workshop RD&D portfolio and roadmap	Q3 2011
		Engage with stakeholders to secure additional support and funding to develop portfolio and roadmap	Q4 2011
	Meg Smith, Light Labs, Philips, NA	Track and publicize annual outcomes of portfolio and roadmap	Q4 2011

## STRATEGY 4-2: DEVELOP SMART LIGHTING TECHNOLOGIES, SYSTEMS AND SOLUTIONS THAT ARE OPTIMIZED FOR ENERGY SAVINGS, DEMAND RESPONSE, RENEWABLE ENERGY AND HUMAN PERFORMANCE

The Strategic Plan has aggressive goals for ZNE in the residential (2020) and commercial sectors (2030); these goals are based in a vision for California's energy future that includes integrated demand side management (IDSM) and renewable energy to create not only most energy efficient environment, but also the healthiest and most productive built environment in the world. To address the numerous barriers facing these efforts, California must collectively create smarter lighting, addressing issues that range from human behavior to systems interoperability. To accomplish these objectives, numerous initiatives—

<sup>38</sup> The Lighting Portal is an online resource for lighting research activities and information. It was developed by the CLTC and is funded by the CEC's PIER program. For more details, visit <http://cltc.ucdavis.edu/content/view/80/82/>.

including novel approaches to energy efficiency program delivery—will be required. To maximize progress made in other sections of this action plan, this effort will launch in 2012.

## 4-2 ACTION PLAN (2010–2012)

Milestone	Champion	Key Actions	Timeline
<b>4-2-1</b> Research and develop solutions that lead to a 25% reduction in lighting power density (LPD) and hours of use through smart integrated controls	TBD	Mine existing data sources to establish LPD baseline (e.g., 2010 Residential Lighting Metering Study <sup>39</sup> )	Q1 2012
		Explore strategies and requirements for “smart integrated controls” to reduce LPD by 25% over current T24 standards	Q2 2012
		Implement LPD reduction strategies (e.g., in pilots, state buildings, etc.)	Q3 2012
<b>4-2-2</b> Experiment with novel programs to launch new technologies which help create improved best practices in the marketplace	TBD	Convene industry experts to brainstorm novel approaches to launch new technologies	Q4 2011
		Identify top 5-10 novel approaches; create detailed account of expected outcome for approaches with greatest potential for success	Q4 2011
		Coordinate with pilot programs identified in milestones Goal 1 and Goal 2 (in 2014–2016 cycle if necessary)	Q1 2012
		Track and assess success of novel launch approaches	Q1 2012
<b>4-2-3</b> Develop a research plan for exploring non-energy lighting performance, including economic, human factors, style, etc.	TBD	Assess existing research on non-energy lighting performance (including research from LBNL, Lighting Resource Center, CLTC, <i>et al.</i> )	Q1 2012
		Convene stakeholder meeting to develop needs assessment for non-energy performance	Q1 2012
		Create research plan; include expected use of findings for lighting education (Goal 3)	Q1 2012
		Conduct research	Q1 2012
		Publish and publicize results	Q4 2012
<b>4-2-4</b> Develop and use market intelligence on energy use patterns, best practices and trends and behaviors with industry partners	TBD	Compile existing market intelligence on energy use patterns, trends and behaviors	Q1 2012
		Convene industry partners to develop gap analysis of existing market intelligence	Q1 2012
		Create research plan; include expected use of findings for lighting education (Goal 3)	Q1 2012
		Publish and publicize results	Q4 2012

<sup>39</sup> KEMA Inc., 2010.

Milestone	Champion	Key Actions	Timeline
<b>4-2-5</b> Commission a study to assess best practices in RD&D programs (inside and outside of the energy efficiency industry)	TBD	Craft Request for Proposals (RFP) and project description to assess best practices in RD&D	Q2 2012
		Assess existing best practices research in key related industries	Q2 2012
		Publish and publicize results	Q3 2012
		Incorporate findings into future best practices lighting strategies	Q4 2012

## STRATEGY 4-3: DESIGN CREATIVE, HIGH-PROFILE DEMONSTRATIONS OF ADVANCED LIGHTING TECHNOLOGIES THAT ARE SCALABLE, TARGETED AND LEVERAGE REGIONAL, STATEWIDE AND NATIONAL PROJECTS

Many chapters of the Strategic Plan rely on the power of public demonstration projects to advance the technologies necessary to achieve ZNE goals. Demonstration projects provide high-profile opportunities for end user groups (and the general public) to view and experience best practice lighting, while simultaneously providing key data for RD&D activities. While considerable demonstration efforts are already underway in California—including those operated by the utilities, the CEC's PIER program and U.S. DOE's solid state lighting demonstration GATEWAY program<sup>40</sup>—these efforts must be coordinated to ensure that results are replicable and available to stakeholders and that successful technologies and systems are promoted on a larger scale. As progress is being made in IOU and PIER pilot programs and the Lighting Market Transformation program, efforts will be focused on this strategy in 2012.

### 4-3 ACTION PLAN (2010–2012)

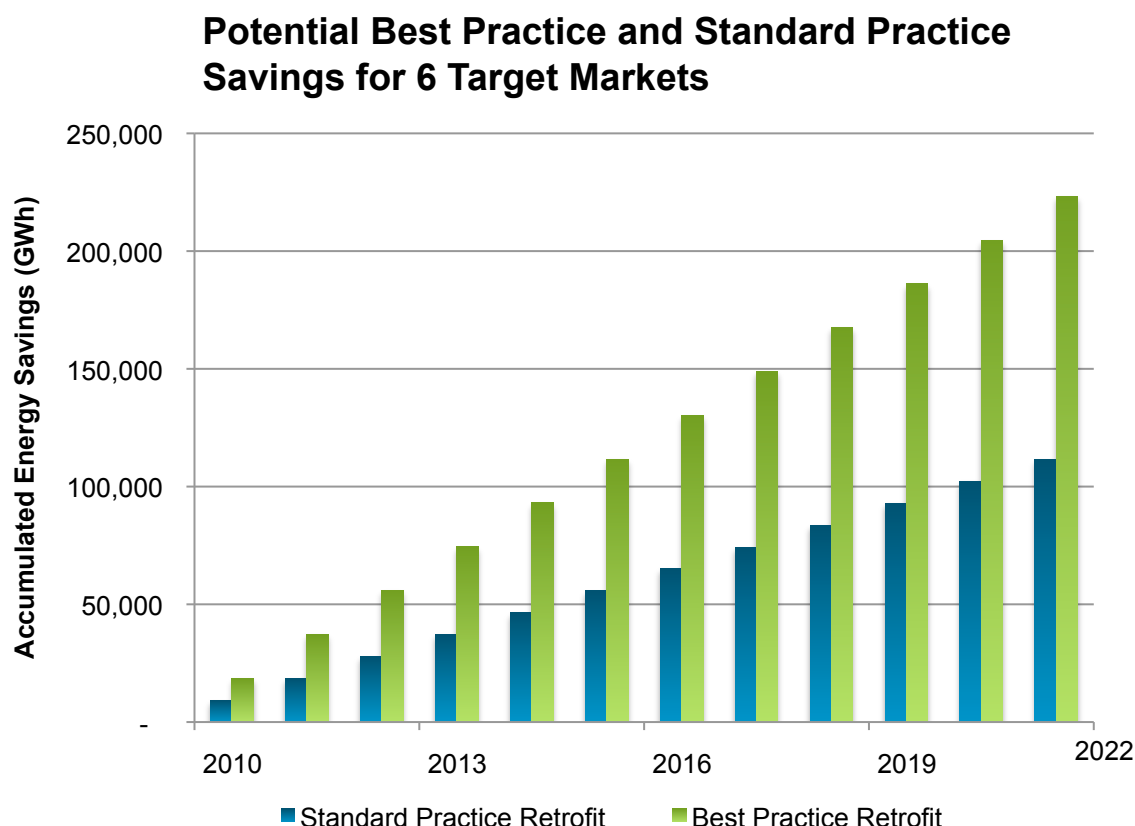
Milestone	Champion	Key Actions	Timeline
<b>4-3-1</b> Develop standardized framework that identifies goals, objectives, field protocols and expected outcomes for demonstration projects	TBD	Review and understand existing demonstration projects and related frameworks	Q1 2012
		Develop preliminary framework that identifies goals, objectives, field protocols and expected outcomes	Q2 2012
		Circulate preliminary framework among stakeholders for review and identification of additional needs for information and metrics	Q2 2012
		Finalize framework; publish and promote	Q3 2012

<sup>40</sup> The GATEWAY Program installs high-performance SSL products for general illumination and evaluates their performance in terms of energy consumption, light output/distribution and installation/interface/control issues. Qualitative performance is also investigated via feedback surveys of the relevant user communities. Recent and current projects include LED street lighting demonstrations in San Francisco's Sunset District, an LED roadway lighting demonstration in Palo Alto and LED parking lot lighting at a West Sacramento supermarket.

Milestone	Champion	Key Actions	Timeline
		Track use of framework	Q4 2012
<b>4-3-2</b> Establish a formal, universal process for data collection, analysis (evaluation and measurement) and technology handoff of RD&D demonstrations	TBD	Coordinate with RD&D advisory body to review and understand relevant existing processes for RD&D demonstration projects	Q1 2012
		Establish and document preliminary process for standardizing data collection, analysis, and technology handoff processes	Q2 2012
		Circulate preliminary process document among stakeholders for review and identification of additional needs	Q3 2012
		Finalize process and build into framework described in Milestone 4-3-1	Q4 2012
<b>4-3-3</b> Design collaborative demonstration programs that are highly visible, scalable, targeted and leverage other demonstration efforts	TBD	Coordinate with PIER, utility emerging technologies programs and other stakeholders to develop guidelines for collaborative demonstration programs	Q1 2012
		Implement demonstration projects	Q2 2012
		Evaluate demonstration projects	Q3 2012
		Share and publicize evaluation results	Q4 2012
<b>4-3-4</b> Establish formal feedback program that leverages the CPUC web portal to disseminate results and lessons learned from demonstrations	TBD	Leverage efforts described for Milestone 4-3-3 to produce relevant lessons learned for demonstration projects	Q4 2012
		Share and publicize results on CPUC web portal and other relevant sites	Q4 2012

## APPENDIX A

### BEST PRACTICES



Per the Strategic Plan, best practices lighting includes “coordinated technologies, systems and design approaches, which (through research and experience) demonstrate the ability to consistently achieve above standard results while avoiding negative environmental impacts. Best Practices change over time as improved components, technologies, systems and design approaches become available.”<sup>41</sup>

The figure above demonstrates the total technical potential savings from best practice lighting retrofits in six space types. The figure is primarily intended to illustrate the benefits from the using best practices versus standard practices over 10 years. Calculations are based on accepted estimates for total building stock, assumed hours of operations, demonstrations and verified savings results from both standard and best practice approaches.<sup>42</sup> The figure illustrates that best practices have the potential to save approximately half of the energy that would be consumed by standard practice installations. The table below provides details regarding on these six space types as well as the technologies and systems included in the standard practice and best practice retrofits.

<sup>41</sup> CPUC, 2010. Page 119.

<sup>42</sup> Detailed accounting including source and assumption data is in the 2010 Lighting Technology Overview (CLTC, 2010).

Space Types	Best Practice Retrofits	Standard Practice Retrofits
<b>Commercial Office</b>	Task/Ambient lighting with occupancy and daylight controls with 73% energy savings or 0.5 Watts/sq ft	Retrofit of ambient lighting system with 37% energy savings or 1.1 Watts/sq ft
<b>Educational Classrooms</b>	Integrated Classroom Lighting System with occupancy controls with 65% energy savings or 0.7 Watts/sq ft	Recessed troffer fixtures with occupancy controls with 50% energy savings or 1.0 Watts/sq ft
<b>Residential Downlights</b>	High quality LEDs or SSL fixture system with 79% energy savings	Compact fluorescent (CFL) fixture system with 60% energy savings
<b>Commercial Downlights</b>	High quality LEDs or SSL fixture systems with 78% energy savings	Compact fluorescent (CFL) fixture system with 54% energy savings
<b>Exterior Lighting</b> (e.g., Parking lot pathway, not including parking garages)	Smart Bi-level lighting systems with occupancy and daylight controls with 40% energy savings	Standard lighting with photocell controls with 0% energy savings
<b>Interior HID Applications</b> (e.g., retail and industrial)	Electronic HID ballasts with 25% system energy savings or 0.75 Watts/sq ft	Magnetic HID ballasts with 0% energy savings or 1.0 Watts/sq ft



## APPENDIX B

### KEY TARGETS

Market diffusion of new technologies begins with a very small set of innovators (perhaps 1 percent to 2 percent of the market) who are inspired to create properties with best practices lighting. In general, owners and designers of projects that achieve Gold and Platinum levels in LEED New Construction (NC) represent this leadership, along with a handful of ZNE buildings with best practice lighting already developed in California over the last few years. In an application of market diffusion theory, the earliest adopters of LEED-NC tended to be private schools, colleges and universities, environmental groups and corporate offices—entities with an interest in being seen as innovative, and also markets where more time spent on design was allowable within the business framework. A similar pattern of innovators is anticipated in best practices lighting. Three key target groups that, with the right cultivation and support can help advance best practices lighting are:

- **Schools and Universities.** Educational institutions have strong commitments to energy reduction and climate change mitigation. Traditional barriers to advanced lighting—including first costs and split incentives—are lessened with schools and universities, as most institutions own buildings, use lifecycle analysis, can access low-interest capital and are well-versed in the state's incentives and rebate systems. In California, both K-12 and higher education have already demonstrated an interest in deep energy efficiency and ZNE projects (e.g., LA Community College, UC Merced, UC Davis). More, schools have substantial advanced lighting activities underway, and are well organized to cooperate on projects (e.g., the Collaborative for High Performance Schools [CHPS]). Educational buildings also offer opportunities to engage students and the community in learning activities, provide green job training centers and organize group purchases related to energy and renewable systems.
- **Offices.** Office space represents a substantial portion of the commercial building market in California and are the most active market in ENERGY STAR benchmarking. California utilities have organized with leading utilities around North America to initiate the Office of the Future Consortium, which has created pilots incentive programs to “go deep.” Offices are a target market for the U.S. Department of Energy's Commercial Lighting Solutions program, and are included in the Commercial Real Estate Alliance. Government agencies and other organizations are beginning to recognize the goldmine of energy savings potential available within this building type.
- **Government Buildings.** The public sector can lead California's adoption of best practices lighting. The State has a number of energy efficiency and renewable initiatives including the Department of General Services' (DGS) Green Building Initiative<sup>43</sup> and the State Architect's specifications for new state facilities. In addition to the state government, there are local governments leading sustainability efforts including, Santa Monica, Huntington Beach, and many others committing to ZNE and sustainability goals in the next 10 years—which will need to include best practices lighting in order to achieve these goals. More, the purchasing power of the governmental sector can lead society in the market transformation to ZNE buildings and can catapult the adoption of sustainable technologies from early adaptors to the majority. California's federally funded ARRA projects are other examples of government projects that lead the early adoption of many best practice solutions including LED streetlights, bi-level parking and stairwell lighting, wireless lighting and HVAC controls, demand control commercial kitchen ventilation, etc.

<sup>43</sup> The Green Building Initiative (Executive Order S-20-04) challenges state government to demonstrate leadership in energy efficiency and environmental responsibility in state buildings, while also reducing the impact state facilities have on climate change. To meet the initiative's goals, Governor Schwarzenegger created the Green Action Team, a Cabinet-level group working to implement the Green Building Initiative. For more details, visit <http://www.green.ca.gov/factsheets/GBI-Factsheet.htm>.

## APPENDIX C

### ADDITIONAL STATE AND NATIONAL PARTNERS

While California is in a leadership position in developing specific strategies and actions for zero net energy buildings and best practices lighting, there is related work happening at multiple levels of government and industry. As part of this action plan, effective strategies for adoption in California should be tracked, and partnerships should be developed that help coordinate lighting best practices. Examples:

- **National Electrical Manufacturers Association (NEMA)** develops energy efficiency policy initiatives on a product or industry basis, advises policymakers and works with various coalitions. As part of the industry's leadership to make energy efficiency a key component of a comprehensive energy policy, NEMA supports a number of efforts to promote high-benefit lighting including energy efficiency, quality and other benefits. A few examples include the National Lighting Bureau and the Lighting Controls Association which provide case studies emphasizing the quality of lighting systems.
- **California Lighting Controls Training Program (CALCTP)** is a statewide initiative aimed at increasing the use of lighting controls in commercial buildings and is funded with a \$5 million, two-year grant from the U.S. Department of Labor. The CALCTP consists of the International Brotherhood of Electrical Workers / National Electrical Contractors Association (IBEW/NECA), the California electric utilities, the CLTC, the California Community College system, the CEC and lighting controls manufacturers.
- **Emerging Technologies Coordinating Council (ETCC)** is comprised of representatives from IOUs, SMUD, the CPUC and the CEC, the ETCC facilitate the assessment of emerging technologies. ETCC's assessments—including LED streetlights, under-cabinet and refrigerated display cases—have driven more advanced lighting products into IOU programs. The ETCC meets four times a year.
- **State of California Energy Policy Advisory Committee (EPAC)** is a forum for state agencies to implement and continuously improve energy policy and operations at all state facilities. The EPAC proposes, advises, and report on energy and related environmental, water and sustainability issues, priorities, policies, strategies, and programs and, implement activities in support of laws, regulations and executive mandates. The EPAC meets quarterly.
- **The University of California (UC) and the California State Universities (CSU) Systems** comprise 33 campuses with 10 UC and 23 CSU campuses. Almost all campuses have sustainability plans and goals that include energy efficiency goals. Both the UC and CSU systems have numerous best practices and ZNE buildings. The 33 campuses have partnered through CIEE with the CEC PIER program in demonstrating the best practice lighting technologies developed by PIER. The campuses also act as market transformation agents and early adopters by purchasing and adopting these best practice solutions.
- **U.S. DOE's Building Technologies Program** has set a goal to achieve marketable zero net energy commercial buildings in all climates by 2025. As part of its Commercial Building Initiative (CBI), DOE has developed key alliances and partnerships to involve industry representatives in setting research priorities and offer advice on real-world implementation and deployment.
- **U.S. Green Building Council (USGBC)** has been a driving force in integrated design, commissioning and energy modeling. While some green buildings have not reached their performance potential, USGBC has carried a strong message, and many of the best energy buildings are also LEED certified. California chapters of USGBC are potential partners in reaching the design and owner communities.

## APPENDIX D

### CALIFORNIA'S LIGHTING SUCCESS STORIES

**San Jose State University (SJSU).** SJSU applied best practices with total system upgrades at its Dr. Martin Luther King Jr. Library. The project included installing occupancy sensors on the library book stack lighting, retrofitting inefficient fixtures, and converting to spectrally enhanced (5000 K) lighting. These measures reduced energy consumption at the building by 22 percent while significantly enhancing building aesthetics. The project is saving over \$300,000 and more than 1,900,000 kWh annually.<sup>44</sup>

**San Diego City College.** As part of a districtwide effort to reduce energy consumption and protect natural resources, a daylighting retrofit project for the Harry West Gym involved replacing High Intensity Discharge (HID) light fixtures with daylight harvesting fixtures, and incorporating high output T-5 light fixtures for the evening hours. The project is saving between \$17,000 and \$18,000 annually in electricity costs. Additional benefits include HVAC savings, improved lighting levels during daylight hours and a 50 percent reduction in labor costs (due to reduced materials replacement from longer-lasting lights).<sup>45</sup>

**U.S. Navy LED Retrofit.** In 2010, the U.S. Navy retrofitted lighting at two bases in California—one of the largest retrofits in Naval history. At Port Hueneme and Point Mugu, high-efficiency LED lights replaced 430 high pressure sodium streetlights, 549 fixtures in residence quarters and 105 fixtures in parking and general areas. The project reduced energy consumption by 317,445 kilowatt hours (a reduction of 228 metric tons of CO<sub>2</sub> emissions) and reduced the bases' electric bills by more than \$45,000 annually.<sup>46</sup>

**Alameda County SEL Retrofit.** Spectrally enhanced lighting (SEL) is a lighting design technique that changes the color of light to be closer to daylight, which allows lighting levels to be reduced to save energy while still achieving visual acuity. In 2008, Alameda County retrofitted 52 buildings covering more than 3 million square feet and nearly 68,000 lamps. The project yielded annual energy savings of nearly \$410,000 and the county expects to recoup the cost of the \$1.79 million project in less than four years.<sup>47</sup>

**UC Davis Parking Garage and Lot Retrofits.** As part of its Smart Energy Initiative, UC Davis sought ways to reduce lighting energy consumption on campus. The campus installed bi-level parking garage luminaires that integrate induction sources and occupancy-based dimming controls in its North, West and South parking garages and lots in 2008 and 2009. These technologies offer significant benefits, including instant light level changes, long life (up to 100,000 hours—which reduces maintenance costs), good color rendering, and excellent resistance to vibration. The retrofits have helped generate significant savings for

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<sup>44</sup> U.S. DOE, 2010. Spectrally Enhanced Lighting: San Jose State University Case Study. Last modified November 2010, accessed January 17, 2011, [http://apps1.eere.energy.gov/buildings/publications/pdfs/corporate/sel\\_sanjosestateuniv\\_cs.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/corporate/sel_sanjosestateuniv_cs.pdf).

<sup>45</sup> Mission Times Courier (San Diego), 2009. San Diego Community College District Projects Honored for Sustainability and Design. Last modified July 31, 2009, accessed January 17, 2011, [http://www.missiontimescourier.com/article/Community\\_News/Local\\_News/San\\_Diego\\_Community\\_College\\_District\\_projects\\_honored\\_for\\_sustainability\\_and\\_design/28254](http://www.missiontimescourier.com/article/Community_News/Local_News/San_Diego_Community_College_District_projects_honored_for_sustainability_and_design/28254).

<sup>46</sup> Environmental Leader LLC, 2010. Naval Bases' LED Lighting Retrofit to Save 60% in Energy. Last modified February 24, 2010, accessed January 17, 2011, <http://www.environmentalleader.com/2010/02/24/naval-bases-led-lighting-retrofit-to-save-60-in-energy/>.

<sup>47</sup> U.S. DOE, 2010. Spectrally Enhanced Lighting: Alameda County Case Study. Last modified November 2010, accessed January 17, 2011, [http://apps1.eere.energy.gov/buildings/publications/pdfs/corporate/sel\\_alameda\\_cs.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/corporate/sel_alameda_cs.pdf).

the university: annual savings are expected to reach 1.3 million kWh.<sup>48</sup>

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<sup>48</sup> Matt, C., 2010. Lighting Retrofits: Bi-Level Induction Lamps Reliable, Efficient. Maintenance Solutions. Last modified September 2010, accessed January 17, 2011, <http://www.facilitiesnet.com/lighting/article/Lighting-Retrofits-BiLevel-Induction-Lamps-Reliable-Efficient--11994>.

CEC PIER, 2010. Case study: Bi-Level Induction Parking Garage Luminaires. Accessed January 17, 2011, [http://cltc.ucdavis.edu/images/documents/case\\_studies/ucd%20induction%20final.pdf](http://cltc.ucdavis.edu/images/documents/case_studies/ucd%20induction%20final.pdf).

## APPENDIX E

### RELATED DOCUMENTS

**BPA Northwest Energy Efficiency Technology Roadmap.**<sup>49</sup> With a renewed emphasis on RD&D, BPA's example includes both visual references and detailed accounting of actors in lighting RD&D. The BPA roadmap provides clarity on key drivers (environmental/global, market, policy and regulatory, and technology innovation), products and services needed to address identified drivers and gaps in existing R&D programs designed to address identified technology needs.

**Illuminating Engineering Society (IES) Lighting Handbook, 10th Edition.**<sup>50</sup> The IES Handbook provides information related to lighting and lighting design. It includes explanations tailored to professionals involved in lighting decisions including practitioners, designers, architects, and engineers. The 10<sup>th</sup> Edition embeds sustainable practices throughout, including "refinement of light level criteria, definitive criteria related to brightness and user impressions, factors influencing power and energy use for lighting, and methods to minimize light trespass and light pollution."

**New Buildings Institute Advanced Lighting Guidelines.**<sup>51</sup> The 2010 Advanced Lighting Guidelines—a staple of lighting professionals' tool kits, including research, current technologies and best-practice design strategies—includes updated material and launch as a new electronic version: ALG Online. The online edition is regularly updated by editors and contributors and continually enhanced through comments from ALG users.

**U.S. DOE Solid SSL Research and Development: Manufacturing Roadmap.**<sup>52</sup> A product and process the California can leverage, the U.S. DOE's roadmap includes core technology research, product development and a new SSL manufacturing initiative to accelerate adoption through manufacturing improvements that reduce costs and enhance quality. The Manufacturing Roadmap was created in partnership with approximately 300 stakeholders in the SSL industry and is intended to guide future planning for DOE's R&D activities.

**Vision 2020: Lighting Technology Roadmap.**<sup>53</sup> The U.S. DOE's Office of Building Technology, State and Community Programs is developing a series of technology roadmaps. The Lighting Technology Roadmap focuses on opportunities in commercial lighting and aims to guide cooperation among public and private researchers, lighting companies, and other state and federal offices to help the lighting industry achieve a long-term vision for 2020 that includes enhancing human performance and creating minimal impacts on the environment during their manufacturing, installation, maintenance, operations, and disposal.

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<sup>49</sup> BPA, 2001. Northwest Energy Efficiency Technology Roadmap. Last modified July 2010; accessed January 17, 2011, <http://www.bpa.gov/corporate/business/innovation/docs/2010/NW%20Energy%20Efficiency%20Technology%20Roadmap%20March%202010.pdf>.

<sup>50</sup> IES, 2010. 10th Edition of the IES Lighting Handbook. Accessed January 17 2011, <http://www.ies.org/handbook/>.

<sup>51</sup> "Welcome to Advanced Lighting Guidelines," accessed January 17, 2011, <http://www.algonline.org/>.

<sup>52</sup> U.S. DOE, 2009. Solid-State Lighting Research and Development: Manufacturing Roadmap. Last modified September 2009, accessed January 17, 2011, [http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl-manufacturing-roadmap\\_09-09.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl-manufacturing-roadmap_09-09.pdf).

<sup>53</sup> U.S. DOE, 2010. Vision 2020: Lighting Technology Roadmap. Accessed January 17, 2011, [http://zeroenergycbc.org/pdf/DOE%20lighting%20roadmap%20vision2020%20\(2000\).pdf](http://zeroenergycbc.org/pdf/DOE%20lighting%20roadmap%20vision2020%20(2000).pdf).

## APPENDIX F

### LIGHTING ACTION PLAN OUTREACH LIST & WORKSHOP ATTENDEES

Jerine Ahmed, Sempra Energy Utilities	Robert Hammon, Con Sol
Janea Albright, LADWP	Mikhail Haramati, California Public Utilities Commission
Mahlon Aldridge, Ecology Action	Campbell Hawkins, Southern California Edison
Leon Alevantis, California Department of Public Health	Lisa Heschong, Heschong Mahone Group, Inc.
Dave Alexander, Pacific Gas & Electric Co	Shawn Holland, California State University, San Bernardino
Daisy Allen, KEMA, Inc.	Pam Horner, Osram Sylvania
Ammi Amarnath, Electric Power Research Institute	Noah Horowitz, Natural Resources Defense Council
Adela Andaluz, FEIT	Owen Howlett, Heschong Mahone Group, Inc.
Gregg Ander, Southern California Edison	Ted Huang, WebCOR Builders
Cynthia Austin, Heschong Mahone Group, Inc.	Alexander Jackson, Natural Resources Defense Council
Doug Avery, SCE	Mark Jensen, Sempra Utilities
Dave Backen, Ecos	Karl Johnson, CIEE
Alex Baker, U.S. Environmental Protection Agency	Linda Jordan, LADWP
Peter Barnwell, U.S. Environmental Protection Agency	Winsey Kan, Pacific Gas & Electric Co.
Nate Bellino, Pacific Gas & Electricity Co.	David Kaneda, Integrated Design Associates, Inc
Athena Besa, San Diego Gas & Electric Co.	Richard Karney, U.S. Department of Energy
David Bisbee, Sacramento Municipal Utility District	Dana Kennedy, Richard Heath & Associates, Inc.
Juan Carlos Blacker, PECO, Inc.	Laura Kimes, Southern California Edison
Monica Blakeslee-Kish, Ecos	Elizabeth Knox, CLTC
Alex Boesenberg, NEMA	Robert Koenig, William J. Clinton Foundation
Norm Boling, Deposition Sciences	Bernie Kotlier, IBEW-NECA Cooperation Committee
Norm Bourassa, California Energy Commission	Paul Kuhlman, Adura Technologies
Jim Brodrick, Department of Energy	Jennifer Lawrence, CREE
Karl Brown, UC-CIEE	Russ Leslie, Lighting Research Institute & RPI
Jennifer Burns, Philips Lighting Company	Kae Lewis, California Energy Commission
Petra Calabero, Summit Public Affairs	Alice Liddell, ICF International
Jenna Canseco, KEMA, Inc.	Robert Lutes, Douglas Emmett
Paul Carp, Pacific Gas & Electric Co.	George Lwin, California State University, Pomona
Sidney Chan, Integrity International Development Corp.	Vireak Ly, DES, CSBU
Caroline Chen, Southern California Edison - Evaluation	Lela Manning, Sempra Utilities
Andy Chiang, Integrity International Development Corp.	John Martin, International Association of Lighting Designers (IALD)
Terry Clark, Finelite	Dominic Masiello, Integrity International Development
Brett Close, Southern California Edison	Beatrice Mayo, Pacific Gas & Electricity Co.
H Colbert, Energy Source Solutions	Roy McBrayer, Department of General Services
Lee Cooper, Pacific Gas & Electric Co.	Che McFarlin, California Energy Commission
Hilary Corrigan, California Energy Markets	Terry McGowan, Lighting Ideas, Inc.
Cheryl Cox, Division of Ratepayer Advocates, CPUC	Jon McHugh, McHugh Energy Consultants
Gary Crawford, General Electric	Erik Milz, Philips Lumileds
Dustin Davis, PIER	Cynthia Mitchell, TURN,
Donn Davy, W&M	Jerry Mix, WattStopper
Andrea Denver, Pacific Gas & Electric Co.	Michael Morris, General Electric
Reuben Deuming, TURN	Craig Morrison, AutoCell Electronics, Inc.
Blair Doane, Pierce College	Mike Neils, M. Neils Engineering, Inc.
Marshall Dunbar, Beta-Kramer LED	Paul Notti, Honeywell
Michelle Dyck-Turner, California State University, San Bernardino	Marvin Nushwat, Pacific Gas & Electric Co.
Teresa Enos, Richard Heath & Associates, Inc.	Susan Oman, Nexus Market Research Inc.
Carlos Espinoza, Southern California Edison	Dawn Ortiz-Legg, Light Group Industries/EcoLumens
Lara Ettenson, Natural Resources Defense Council	Erik Page, California Public Utilities Commission
Jeff Farrington, Exposure Illumination Architects, Ltd	Konstantinos Papamichael, CLTC
Aaron Feit, FEIT	Benjamin Parco, Parco Homes
Gary Fernstrom, Pacific Gas & Electric Co.	Jim Parks, Sacramento Municipal Utility District
Jeannine Fisher, Acuity Brands	Doug Paton, Adura Technologies
Gary Flamm, California Energy Commission	Lenard Pettis, CSU
Rebecca Foster, Consortium for Energy Efficiency, Inc.	Teresa Pham, Southern California Edison
Thomas Gackstetter, LADWP	Charles Pilcher, JPI International Development, Ltd.
Steve Galanter, Southern California Edison - EE	Dean Pourmaras, Watt Stopper
Richard Genese, EE, CSBU	Kourtney Preston, FEIT
Zach Gentry, Adura Technologies	Gene Quisisem, Greenray
Barbara George, Women's Energy Matters	Shilpa Ramaiya, Pacific Gas & Electric Co.
Nicole Graeber, CLTC	Keith Reed, Pacific Gas & Electric Co.
Derek Greenauer, D&R International, Ltd.	Randy Reid, Luxim
Richard Greenburg, Southern California Edison - EE	Steven Richards, California State University, Dominguez Hills
Ujjvala Gupta, California Public Utilities Commission	Roland Risser, Department of Energy
Arlene Guzman, Vantage Point Venture Partners	David Rivers, Southern California Edison
Tom Hall, Los Angeles Community College District	Cynthia Rogers, California Energy Commission
Brian Halliwell, Lights of America	Francis Rubinstein, Lawrence Berkeley Laboratory

Ron Runkels, NEMA  
Irene Salazar, California Energy Commission  
Shahana Samiullah, Southern California Edison  
Connie Samla, SMUD Energy & Technology Center  
Peter Schwartz, Peter Schwartz and Associates  
Thor Scordelis, Xicato  
Keith Scott, Bridgelux, Inc.  
Chris Scruton, California Energy Commission  
Michael Seaman, CLTC  
Shelli Sedlak, GE Lighting and Industrial  
Will Shatford, LPI  
Margaret Sheridan, California Energy Commission  
Maziar Shirakh, California Energy Commission  
Michael Siminovitch, CLTC  
Kristina Skierka, California Public Energy Commission  
Brian Smith, Pacific Gas & Electricity Co.  
Daniel Spiro, Exposure Illumination Architects, Ltd  
Steve Starks, LADWP  
Anu Teja, NEEA  
Jackie Tran, Southern California Edison

Daniel Trevino, WattStopper  
Michael Ursem, Southern California Edison  
Rohit Vaidya, Nexus Market Research Inc.  
Dirk Van Ulden, University of California, Office of the President  
Leora Vestel, California Energy Markets  
Ed Vine, CIEE  
Subid Wagley, Pacific Gas & Electric Co.  
Marsha Walton, New York State Energy Research and  
Development Authority  
Anthony Wayne, California Retrofit, Inc.  
David Weightman, California Energy Commission  
Phil Westbrook, California State University, San Bernardino  
Jane White, Finelite, Inc.  
Don Wiggins, Sempra Utilities  
Kathy Williams, Richard Heath & Associates, Inc.  
Phil Williams, WEBCOR Builders  
Jim Wyatt, Pacific Gas & Electric Co.  
Cheryl Wynn, Southern California Edison  
John Yang, Integrity International Development Corp.